THE

# FOUNDRY TRADE JOURNAL

*WITH WHICH IS INCORPORATED*

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**THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.**

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## Forthcoming Events.

OCTOBER 18.

*Institute of Metals (Birmingham Local Section)*:—Ordinary meeting at Birmingham.

**Institute of British Foundrymen.**

OCTOBER 13.

*Lancashire Branch (Burnley Section)*:—Opening meeting at Burnley. "Practical Application of Science to Motor Cylinder Making." Paper by W. West, of the Leyland Motors, Limited.

OCTOBER 15.

*Sheffield and District Section*:—Joint meeting at Sheffield. Sorby Lecture, "The Influence of Pressure on Rocks and Metal," by Cosmo Johns.

OCTOBER 20.

*Wales and Monmouth Branch*:—Lecture by Wesley Lambert on "Non-ferrous Metals" at Weston-super-Mare.

## Silicosis.

We have as yet not received much evidence of the prevalence of silicosis among foundry workers, as requested in our last issue, and so far this confirms the view we expressed that there is no serious degree of incidence of the disease in the industry. At the same time we should like to point out to our friends in the industry that it is not sufficient to rely on the absence of positive evidence. What we should like would be for some of the more experienced founders, men who have had responsible positions and who have controlled numbers of workers for 20 or 30 years, to say positively what their experience has been. If they can say with confidence that they have not struck any cases this would be valuable corroborative evidence, whereas the absence of any such statement will not be interpreted as meaning that the trouble is not prevalent.

Is there, for instance, any particular tendency on the part of foundry workers to tuberculosis, which frequently follows silicosis? We think it right to warn employers that if the Order referred to in our last issue is put into force there will be a tendency automatically to regard cases of tuberculosis, which might arise through many causes, as consequent on silicosis, and to rank them as compensation cases accordingly. It need scarcely be added that the premiums for the risks involved will be paid by employers.

The only really likely place where the trouble would be experienced is in the fettling shop, and the recent metal grinding Order should have removed any difficulty here.

We should like the information requested to be sent to us certainly not later than to-morrow October 12, as the necessary evidence has to be before the Home Office on October 15.

## Food for Thought.

The abstract published in our recent issue of the Paper by Mr. F. G. Martin at the Liverpool meeting of the Institute of Metals contains much food for thought, particularly with reference to the proportion of cast iron used in engineering plant. In a particular size of boat requiring 6,000-h.p. engines, Mr. Martin points out that in reciprocating engines nearly 71 per cent. of the total of 176 tons consists of cast iron, whereas in turbines 58 per cent. of the total of 67 tons is cast iron, and on the other hand, in the Diesel engine, only 41 per cent. of the total of 1,400 tons consists of cast iron. Well within the memory of most of us was the time when all ships were engined with steam reciprocating sets; then came the turbine, and now the Diesel engine is rapidly becoming universal. These have involved enormous changes to the foundry industry, and it may well be asked whether the industry has really been organised to extract the maximum business out of these changes. The proportion of cast iron in the three is steadily diminishing, and the ground has been lost to more enterprising competitive materials. The great difference in weight between the oil engine and any form of steam engine is well known, but is in the present case excessive, because the figures for the steam sets in either case include the weight for boiler plant, whereas the Diesel figures include all the auxiliaries.

Doubtless some founders would reply to our correspondent, "Progrès," whose letter on this matter was published in our last issue, by saying that the founder lives by tonnage; we believe this to be shortsighted, as it is based essentially on the view that anything is good enough for cast iron, and the heavier the better. When cast iron is bought on a basis of strength or suitability for its purpose it will be possible to command higher prices, and, indeed, to abandon the system of selling by weight altogether. We therefore sympathise with the point of view indicated in the letter, but at the same time we do not think that the very best modern irons have shown such marked improvement in tensile strength over those now used by the leading marine engineering firms to justify any radical reduction in sections. The problem of the design of castings has to be tackled on rather different lines, and perhaps in no field is there such scope for improvement. In the meantime, we would point out that engineers can scarcely have given up cast iron as a bad job when, in the most modern type of engine, 41 per cent. remains cast iron; the type of engine in which the pressures developed are far higher than any other type of prime mover. Foundrymen have it in their power, when they will, to increase the 41 per cent. very considerably when they stop cast iron being nibbled at by other enterprising vendors of an alternative material at a greatly enhanced price.

## Welcome Co-operation.

The foundry industry is already indebted to the Technical Advisory Committee of the International Foundry Trades' Exhibition, (to be held in the Agricultural Hall next June), which is presided over by Mr. Wesley Lambert, the president-elect of the Institute of British Foundrymen, as it has already succeeded in enlisting the enthusiastic co-operation of several Government departments, the great national research organisations and the metallurgical departments of most of the Universities. These influential bodies are combining together to provide an exhibit which will show clearly their *modus operandi* for providing every section of the foundry and allied industries with fundamental data, improved methods of manufacture and better-quality products, together with concrete achievements. In addition to this there is to be a composite exhibit showing the nature of foundry defects, and methods for the amelioration; interesting castings and artistic productions, all of a non-commercial character. It has been decided that as the exhibition will be on a very much larger scale than formerly, there will be no need to form a scientific instrument section, as this industry will apparently be well represented amongst the commercial exhibits.

XUM

## Foundry Engineers Meet in Manchester.

With the object of interesting the Lancashire business people in the forthcoming International Foundry Trades' Exhibition, to be held at the Agricultural Hall next June, Messrs. F. W. Bridges & Company, Limited, the organisers of the exhibition arranged a luncheon party at the Midland Hotel, Manchester, last Thursday. It was presided over by Mr. H. Winterton, President of the Foundry Trades' Equipment and Supplies Association. He was supported by the vice-Presidents, Mr. A. S. Beech and Mr. D. H. Wood, and the honorary secretary, Mr. K. W. Bridges. The principal guest was Mr. S. H. Russell, President of the Institute of British Foundrymen, whilst amongst other well-known foundrymen were, Mr. E. Longden, President of the Lancashire Section; Mr. R. A. Miles, a past-President of this Section; Mr. T. Makemson, General Secretary of the Institute; Mr. W. M. Rowland (Abrasives, Limited); Mr. F. M. Bailey (Sir W. H. Bailey & Company, Limited); Mr. F. J. Barraball (Blackfriars Foundry Requisite Company, Limited); Mr. G. T. Lunt (Bradley & Foster, Limited); Mr. C. G. Walker (Brightside Foundry & Engineering Company, Limited); Mr. D. W. Lennox (Britannia Foundry Company, Limited); Mr. W. Butterworth (Butterworth Brothers, Limited); Mr. J. Durrans (Durrans & Sons, Limited); Mr. H. Brocklehurst (Empire Engineering Company (Manchester), Limited); Major J. W. Athey (Fordath Engineering Company, Limited); Mr. E. Perrin (Foundry Trades' Equipment and Supplies Association); Mr. A. C. Turner (General Refractories Company, Limited); Mr. R. Hargraves (Grandidge & Mansergh, Limited); Mr. A. H. Evans (E. G. Herbert, Limited); Mr. W. R. Long (Foundry Trade Journal); Mr. W. A. Smith (Pneumatic Conveyance & Extraction, Limited); Mr. J. G. W. Lowe (Sterling Foundry Specialties, Limited); Mr. R. E. Hoy (I. & I. Walker); Mr. G. B. Wallwork (Wallwork & Company (1920), Limited); Mr. G. P. Rawstron (Westoby & Rawstron); Mr. W. Rawlinson (J. W. Jackman & Company, Limited).

Mr. Winterton, after welcoming the guests, sketched the history of the foundation of the "Equipment" Association, and insisted that since its incorporation better service was available for the foundry industry. The Association had no intention of price-fixing or dealing with labour-service conditions. It had been fortunate in interesting the Government departments, the national research organisations, and the Universities in the welfare of the foundry industry to such an extent that practically all of them has co-operated to stage what would be the finest technical exhibition ever arranged for the purpose of exemplifying the application of science for the better understanding and progress of foundry work.

Mr. V. C. Faulkner, a past-President of the Association, dealt with the forthcoming exhibition, and pointed out that actually more space was already booked up than was occupied on the previous occasion (June, 1926). Moreover, it would be more international in character as much interest was being evinced in this manifestation by Continental countries, especially Germany. This was not surprising in view of the large number of overseas visitors expected. It was confidently expected that orders would be placed at the exhibition for delivery to the remotest parts of the world.

Mr. S. H. Russell, in a short discourse, thanked the organisers of the luncheon on behalf of the guests. He complimented the equipment industry on the enterprise they were showing. He was pleased to learn that two sections of the industry —foundry facings and core oils—were instituting specialised research laboratories.

Finally, Mr. K. W. Bridges emphasised the material advantages to be gained by members of the industry attaching themselves to the "Equipment" Association.

A vote of thanks to the chairman, graciously proposed by Mr. W. Butterworth, concluded an extremely enjoyable function.

## Big Foundry Fusion.

In the very near future two well-known Derby engineering firms, the Haslam Foundry & Engineering Company, Limited, and Newton Bros., Limited, will amalgamate. At present, however, the name under which the new business will be styled has not been decided, but as soon as this is known it will be reported in The Foundry Trade Journal.

There is no danger of the employees of either of the firms being adversely affected by the fusion; in fact, our representative was given to understand that it is highly probable that the big development will create more employment in Derby.

Both the Haslam Company, Limited, and Newton Bros. are particularly well-known, not only in England, but abroad. Founded by the late Sir Alfred Haslam, the Haslam Foundry & Engineering Company has the distinction of having introduced cheap meat into the homes of the poor, by reason of the fact that the firm was the pioneer in the manufacture of refrigerators for ships, and thus enabled foreign countries to import frozen mutton into England. Sir Alfred Haslam died a millionaire, and although his title was the sequel to Queen Victoria's visit to Derby in 1891, it is safe to assume that the honour would not have been conferred had he not been able to claim other services to the public than the Mayoralty of Derby. When Sir Alfred died, the management of the business changed hands, and Mr. Jesse Lord, who is the present chairman of the Company, is a native of Lancashire. The chief and most important branch of the firm's operations is the manufacture of refrigerators. They also carry on a large amount of general engineering. One of the most recent developments is the construction of machinery for the artificial silk industry.

For many years Mr. W. G. Haslam, Sir Alfred's brother, was works manager, and he has retained his seat on the directorate. When the new Company is formed he will, we are informed, continue to be a member of the Board.

So far as Newton Bros., Limited, are concerned, the firm is not quite so old as that of Haslam's Foundry & Engineering Company, Limited. During their time, however, they have established a high reputation. During the war, one of the partners, Lt.-Col. Henry Newton, D.S.O., turned his inventive genius to account in France. He went overseas with the Derby Territorials, and he conceived the idea of a trench mortar gun with special advantages. So impressed were the Military Authorities with its possibilities that Lt.-Col. Newton was sent back to England to superintend the manufacture of as many of these weapons as the firm could manufacture. The gun was known as the Newton Pippin, and it became one of the big factors in the long trench warfare that ensued. In peace times the firm has carried out some big and important contracts all over the world. Many of the instruments used in the Post Office are manufactured by Newton Bros., and, in addition, they also maintain a regular supply to the Air Ministry and the Admiralty for the wireless equipment of aeroplanes and battleships. The heads of the firm are natives of Derby. Their father, Mr. Thomas Newton, has now retired from business. The chairman of the company is Mr. C. A. Newton.

As already stated the employees of the firms are not likely to suffer by the amalgamation. The premises of Newton Bros. are on Alfreton Road, and those of Haslam's are situated by the riverside at Little Chester.

## B.C.I.R.A. Annual Meeting.

The annual general meeting of the British Cast Iron Research Association will take place at 12.15 p.m., on Wednesday, October 31, at the Hotel Cecil, Strand, London. The meeting will be followed by luncheon at 1 p.m., at which the President, Major-General Sir Philip A. M. Nash, K.C.M.G., C.B., will take the chair, and immediately afterwards he will give a short Presidential Address.

## Random Shots.

The dinner season draws on apace. It generally happens like this. The Committee of a technical society takes its duties very seriously, and believes that it should promote the social well-being of its members as well as their technical welfare. The matter is discussed and a small minority of members thinks that an annual dinner should be held. Some think that it would be preferable to have a smoking concert, and others want their lady friends, so that they can dance. Various other proposals are made, but the dinner takes place nevertheless; not because it carries a majority, but because the opposition is divided into six or seven camps and cannot agree on an alternative. This happens every year with painful regularity.

* * *

Thus, all over England, by all sorts of groups, the annual dinner will be celebrated, and groups of Englishmen all over the world, from China to Peru, from the Solomon Islands to the Arctic, with nothing more in common than the necessity for sustenance, will find themselves foregathered to share it.

* * *

The great point about a dinner, of course, is the sting in the tail. It is generally understood that toasts are an abomination, that speakers are frequently poor, but by a mysterious alchemy after the inevitable dinner come a group of toasts, as inexorable as fate, to the ruling house, to the diners themselves, and to the rest of their friends.

* * *

Toasts involve after-dinner speeches, of which there are various types, characteristic of their authors. We are all familiar, for instance, with the man who, when called upon, says that when he came into the room he had no idea that his enjoyment of the feast was to be marred in this way, that he is quite unaccustomed to public speaking, and that he nevertheless regards it an honour and a privilege, etc., etc.; etc. . . .

* * *

Then there is the man who trusts to the inspiration of the moment and relies on one or two odd entries on his menu card. He may be fluent or not. In the latter case he begins to er-er-er. All we can do is to remember that to er-er-er in an after-dinner speech is human.

* * *

If he is fluent he manufactures sentences which sound well without saying much while he thinks desperately for a comment with some meat in it. Thus: "Mr President and gentlemen, I am convinced that I am right when I say, and I am sure that you, Mr. President and gentlemen, will one and all agree with me when I say that any remarks I might have made this evening have already been said with eloquence by the previous speakers."

* * *

Then there is the man who breaks off suddenly to say: "and that reminds me of a little story," which proves to have absolutely no connection with the point in hand, and which is linked up with other stories by a tissue of irrelevances.

* * *

An ideal after-dinner speaker, I think, does not apologise for his effort or his choice. He takes that for granted and gets on with the job. An ideal after-dinner speaker is one who speaks without preparation, for such a speech is most appreciated, not merely when it is spontaneous or impromptu, but when it springs out of the occasion itself; when a reply to a toast is really a reply to the proposer, and when the proposer takes account of the topicalities of the dinner and the personalities present.

* * *

Yet how many such speakers are there? Can we wonder that the Lord Dewars are reported in the newspapers? But they cannot attend more than a handful of dinners in a season. For it is a lot to ask that a speech should be topical, should be seasoned with wit and flavoured with that sparkle which still makes us understand the old-time power of the orator.

Marksman.

# Institute of British Foundrymen.

## LANCASHIRE BRANCH.

At the opening meeting of the Lancashire Branch of the Institute of British Foundrymen, held last Saturday, Mr. E. Longden, delivered his Presidential Address, in the course of which he said:—

Mr. Primrose and Gentlemen,—Usually a President takes up office and delivers an address on the opening meeting of the Session, but the Lancashire Branch evidently believes that the duties should commence immediately after election at the Annual General Meeting, which is held in April of each year, and that the Address be given on the opening meeting of the next Session. Like members of other branches, I am of the opinion that the opening meeting of the Session is the better occasion to take up the duties of office.

However, I deeply appreciate the confidence and honour you have conferred upon me by electing me as President of the Lancashire Branch for the period 1928-29. It is, indeed, no light task to follow in the path of the past Branch Presidents.

Since I first joined the Institute through the Lancashire Branch about thirteen years ago I have seen many changes, most of them being for the betterment of the Institute. The strength of the Lancashire Branch stands high and is supreme among the several Branches of the Institute. Such a condition is undoubtedly due to the excellent efforts of past officers rather than geographical location.

Your Council extend a hearty welcome to members generally, but to the new members in particular, to the opening meeting of the Session.

We hope that new and old members, especially those whose work is of a practical nature, will enter as fully as possible into the discussions of the meetings.

The programme of lectures for the current Session easily reaches the usual standard of the Branch. In many respects we should undoubtedly consider it a duty as members of the Institute, apart from personal benefit, to attend as many of the lectures as possible. Good audiences are due to the lecturers who devote so much time to preparation of material often of a very high order for our improvement.

In other parts of the country I have been present at meetings which have been attended by less than a score of men. I do not recollect attending a meeting of the Lancashire Branch without seeing a good gathering. Were it not for the much wider appeal and educational value, through the official organ of the Institute, THE FOUNDRY TRADE JOURNAL, many lectures rendered by eminent men in the industry would be an unreasonable waste of time. The excellent work performed by THE FOUNDRY TRADE JOURNAL cannot be overestimated.

### Standing of the Institute.

The status of the Institute is on a very high level. Its advancement was well marked by the granting of the Royal Charter in 1921. A further step will be recorded when members will be permitted to enter for suitable examinations which will qualify them to use the letters of the Institute as a standard of attainment. The necessary preliminaries have been taken by the General Council and probably 1929 will see the advent of examinations for those who wish to qualify. It is a much belated move, but when carried through will considerably enhance the reputation of the Institute of British Foundrymen.

### International Congress of Foundrymen.

In 1929 Britain will be the venue for an International Congress of Foundrymen. The meeting is arranged to synchronise with our National Convention and Foundry Trades' Exhibition, to be held in London in June of next year. It will, probably, turn out to be the largest gathering of international foundrymen yet brought together. Large contingents are expected from America, Germany, France and Italy. There is reason to think that most nations will be represented. The several branches of the Institute are making preparations for the great event. The Lancashire Branch Council will be pleased to receive suggestions in writing from the members which might aid them to interest and entertain the overseas visitors during their stay in the Lancashire area.

### Trade and Equipment.

There is evidence that the foundry trade, in common with the engineering trade, is improving and will continue to improve granted a continuation of international and industrial peace and understanding.

Whilst there are still many obsolete foundries, it is surprising how much has been done in reconditioning and improving the equipment of many foundries.

In our modern and comparatively educated world it is certainly efficiency in the means of production and distribution of the product which will eventually create the greatest prosperity for all. Warships and armaments may have been necessary in the past, but they will be less helpful to us in the future. The benefits of our 100 years' start in the industrial revolution have long become redundant. Practically all nations of the world have learned how to manufacture goods for themselves, and they are in many cases starting to manufacture with newer and more modern appliances than we possess. We still have far too many ill-equipped works in the Old Country.

### Foundries Without Waste.

Recently we have been informed by an official of an iron works that their foundry has produced only one waster casting in three years. Either British foundrymen are of a very low grade or the statement is a real "Foundry Howler." I prefer to state the latter. If any employer has fictitious facts placed before him of a similar character I advise him to get to know his foundry. An employer who believes in a foundry without waste is being grossly deceived. Foundrymen owe a debt of gratitude to the Editor of THE FOUNDRY TRADE JOURNAL for his timely and corrective remarks made in the editorial of September 20, 1928.

We have enough difficulties and problems in the foundry without having to devote time explaining to our employers that to run a foundry without producing a proportion of defective castings is beyond our power until the human element, knowledge and equipment, are perfect. I venture to state that if every casting received the correct cast-iron metal composition that the percentage of the waste would not be reduced by much more than 5 per cent. In other words, good castings depend on foundry technique and general practice exclusive of just metal composition.

We are thoroughly acquainted with the value of various materials, but we do object to employers being posted with statements and circulars extolling the virtue of a metal or flux which will *eliminate all wasters* in the foundry. Such statements never could emanate from a foundryman.

However, gentlemen, in spite of our trials our existence in the foundry can hardly be termed monotonous. There is abundant opportunity for the exercise of the various qualities of the individual and considerable development is possible in skilled craftsmanship, organisation, science and art. The gloom and grime of the foundry camouflages the real artistic aspect of founding. In this respect there is one branch of our trade, that of the production of bronze and other metal statuary, which is almost neglected by the foundry technical Press and the Institute of British Foundrymen.

With a view to stimulating the latent talent in foundrymen, especially the younger men, I shall talk for just a short time about the production of bronze statuary, showing as examples photographs of figures produced by my brother John. The information, whilst being elementary, is of practical use for beginners.

Apart from the method of producing the bronzes the work of carving and modelling the figures is of a very high-class order.

### ART IN THE FOUNDRY.

The method practised by Mr. John Longden to produce the bronze bust statues of his two daughters is known as the lost wax method, and is as follows:—

An outline sketch is first made of the intended image, as shown in rough sketch, Fig. 1, and a core iron made to suit; having regard to the fact that the mould is to be cast head down. It is more usual to pour such moulds head top uppermost, and after experiencing the difficulties of the work no doubt my brother will adopt the head top position in any similar work.

A core is then made in loam, having approximately the size and shape of the finished casting, with wax venting material located where necessary. The core is fashioned by simply forming a hole in black sand roughly the shape of the intended casting, and working therein loam strengthened with the core iron and vented as already described. The loam used is of a suitable texture to stand the necessary considerable rubbing when dry. When dry the core is set up on its base and roughly modelled to the shape of the

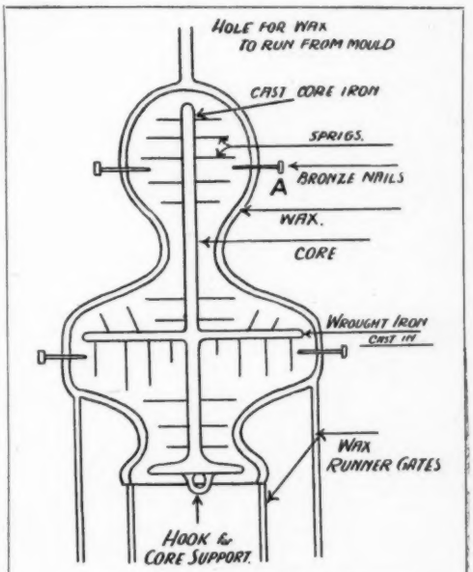


FIG. 1.—METHOD USED FOR CASTING BRONZE FIGURES.

casting. The necessary tools being a card, files, scrapers and sand paper.

The next step is then to take off all over the core surface a $\frac{1}{4}$-in. of material to give the metal thickness. After blackening the core is complete.

A further stage is to melt wax in a large pan and when the material becomes soft and plastic, it is flattened out into layers of $\frac{1}{16}$-in. pieces and then laid all over the surface of the core. It must not be thought that $\frac{1}{16}$ in. is sufficient to form all the contour of the figure, because, as will readily be understood, the core is only roughly the shape of the intended figure, and it would be necessary to add more wax during the process of fashioning the figure.

The next step is the actual modelling or carving of the wax surface to the shape and contour of his daughters' bust, and this surface when reproduced in bronze gave the outer surface required. The wax was scraped, cut and patched until the busts, Figs. 2 and 3, were formed, and which are actual photographs of the work at that stage. The speckled appearance is due to the dusting of the wax image with blacking and whitening to give an even colouration, and to aid photographing, the wax having become very patchy and discoloured during the process of modelling.

D

As will be expected, the modelling was the most difficult, although the most interesting part of the work, and required the patient sitting of his daughters over many hours at various times. The boredom of posing is faithfully reproduced in the bust of the younger daughter, Fig. 2, on the face of which can be seen a distinct look of pensiveness and boredom.

The next step is to form the mould of the outside just as the core under the wax forms the inside, but before actually moulding commenced wax runner gates were provided as shown in Fig. 1, and a wax peg placed on the head to allow the wax to run from the mould at a later stage. Also, since the core had to be anchored, bronze nails were pushed through the wax and well into the core, leaving about 1½ in. protruding above the wax layer. When the mould is afterwards made these nails, of course, are fast in the mould and core as shown at A, Fig. 1.

The model is next stood up on a suitable square board, head upwards, the base of the model on the board.

A quantity of plaster of paris and fine brick dust, in the ratio of 1 to 3, is passed through a $\frac{1}{8}$-in. sieve.

Taking only a small amount of the material at a time, a little dry mineral blacking is added and well mixed together, and then formed into a thin paste by the addition of water. The thin paste formed by plaster of paris, brick dust and mineral blacking is then lightly and carefully washed over the surface of the model to about $\frac{1}{16}$-in. thickness and allowed to dry. Then two further layers of about $\frac{1}{16}$-in. of paste, but without the mineral blacking, is added to the first coat and again allowed to dry.

A suitable moulding box is then laid on the board and around the job. Ordinary and loam bricks are placed in any big spaces formed by the moulding box and the mould, and the vacant spaces then filled with a mixture of plaster of paris and brick dust. The box is next turned over, the board removed, a further moulding box located, wax runners joined to those already made, a hook bolt placed into the lock at the base of the core iron and screwed tight, and the remainder of the box filled with the plaster and brick dust mixture.

The whole of the mould after bolting together is allowed to stand for three days, and then placed for complete drying in the stove for a further three nights and days. It was noted that the wax was all drained out after the first night.

The actual pouring was not attended with much difficulty. The bronze mixture poured is approximately of the composition 88 per cent. copper, 7 per cent. zinc, and 5 per cent. tin.

After the casting is taken from the mould it is often necessary to burn up one or more flaws before actually dressing the casting. There is much patience and work required to file, scrape and polish the bronze casting.

After the bronze has been polished the surface is oxidised. This was done on the work mentioned by simply leaving the statue in a gas-heated stove for about five hours.

Figs. 4 and 5 are the completed bronze models, which stand 21 ins. high, made from the plaster and wax models, shown in Figs. 2 and 3 respectively.

Fig. 6 is a photograph of a life-size* plaster model of a runner making the supreme effort or spurt just before touching the tape. This model is not quite finished, and in view of the great amount of work put into the plaster it is not sure that my brother will proceed to make a bronze casting from it, because of the danger of losing the result of so much effort.

The method of making the "Runner" is named the "Waste" method, and is somewhat different from the wax process described for the busts.

As in the wax method, sketches of the intended model are first made, particularly with a view to locating strengthening irons. Clay is built about the iron skeleton, and the work of shaping the model begun. This is done mainly by the hands aided by various small tools and calipers.

When one has obtained a rough clay model the next step is to produce a plaster-of-paris copy of it. It is a simple matter with a small object, but difficult with a large one. The process produces one model and consists in this case (although there are others, in which gelatine is used, out of which many plaster casts can be made) in taking a plaster mould of the clay model and casting plaster of paris again into the mould so formed, and which is coated with sweet oil to allow a parting, and to aid the careful chipping away of the outer mould after the mould has set. The mould is made in parts like "drawbacks."

The plaster cast is, of course, strengthened with iron, as in the case of the first and original clay model. The irons are coated with shellac varnish to prevent rust passing into the plaster.

Such work should appeal to many of our younger members, and my brother and myself will both be happy to give any further particulars to those interested.

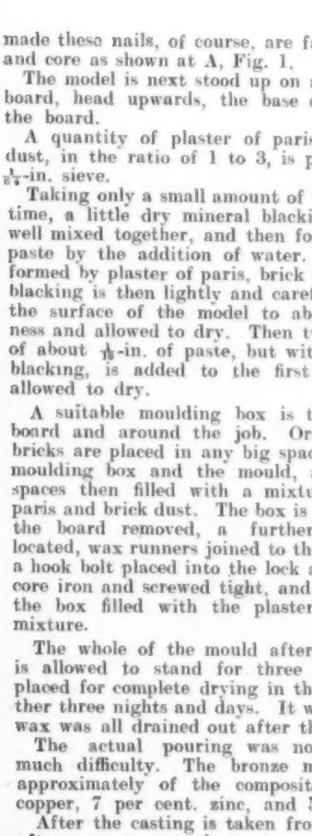

Fig. 2.—Wax Model.

Fig. 3.—Wax Model.

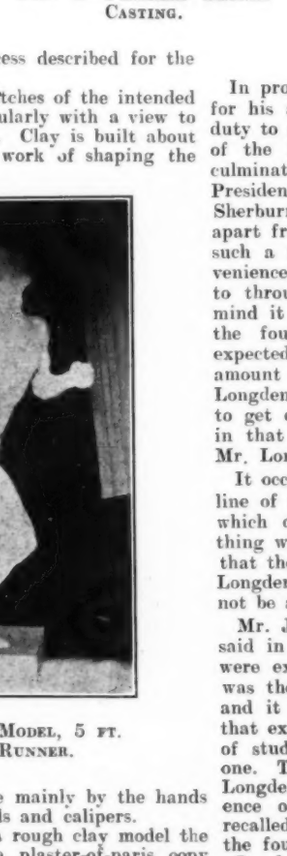

Fig. 4.—Finished Bronze Casting.

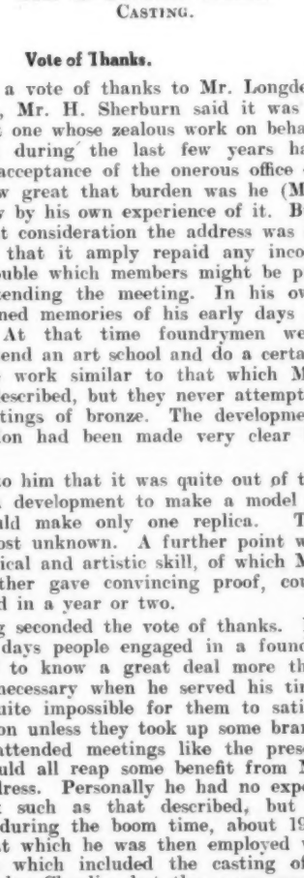

Fig. 5.—Finished Bronze Casting.

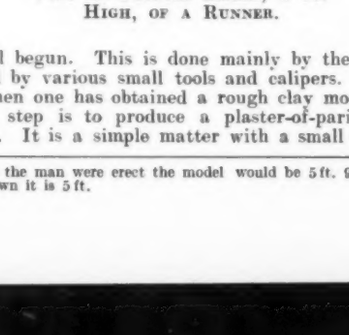

Fig. 6.—Plaster Model, 5 ft. High, of a Runner.

* If the man were erect the model would be 5 ft. 9 ins., but as shown it is 5 ft.

### Vote of Thanks.

In proposing a vote of thanks to Mr. Longden for his address, Mr. H. Sherburn said it was a duty to support one whose zealous work on behalf of the Branch during the last few years had culminated in acceptance of the onerous office of President. How great that burden was he (Mr. Sherburn) knew by his own experience of it. But apart from that consideration the address was of such a nature that it amply repaid any inconvenience or trouble which members might be put to through attending the meeting. In his own mind it awakened memories of his early days in the foundry. At that time foundrymen were expected to attend an art school and do a certain amount of the work similar to that which Mr. Longden had described, but they never attempted to get out castings of bronze. The development in that direction had been made very clear by Mr. Longden.

It occurred to him that it was quite out of the line of modern development to make a model of which one could make only one replica. The thing was almost unknown. A further point was that the technical and artistic skill, of which Mr. Longden's brother gave convincing proof, could not be acquired in a year or two.

Mr. J. Hogg seconded the vote of thanks. He said in these days people engaged in a foundry were expected to know a great deal more than was thought necessary when he served his time, and it was quite impossible for them to satisfy that expectation unless they took up some branch of study or attended meetings like the present one. They could all reap some benefit from Mr. Longden's address. Personally he had no experience of work such as that described, but he recalled that during the boom time, about 1920, the foundry at which he was then employed was offered a job which included the casting of a figure of Charley Chaplin, but they were unable to do it. The vote of thanks was carried unanimously and acknowledged by the President.

# New Foundry of John Harper & Company, Limited, Willenhall.

John Harper & Company, Limited, are actually one of the oldest firms in the foundry history of South Staffordshire, their business having been established in 1790. They were also one of the first firms to manufacture malleable cast iron in this country. At the outset a foundry was laid down to meet the requirements of their own works, and only sufficient "foreign" castings were made to enable the foundry to work to its full capacity and thus ensure the most economical operation. Their own requirements called for very high-grade and free-machining castings. It was early apparent that there was an existing and ever-growing demand for such castings, to cope with which frequent extensions had to be made to buildings and plants. Thus for a long time the Company have specialised in castings up to 3 or 4 cwts. in weight for electrical engineering, hardware and domestic machinery, the aim being the production of perfectly clean and smooth castings, and sufficiently soft to permit of machining at the highest possible speed, such accuracy being obtained as to make it possible for castings to fit straight into jigs when delivered to customers.

In 1925 the demand for grey castings for the electrical industry became so great that the production of malleable iron was stopped in order to increase the facilities for making grey-iron castings, a new foundry being erected on the site of the old annealing furnaces. The whole of the area (3 acres) in the old works was then taken up and for over twelve months a night shift had to be worked.

For a long time the Company have possessed some 30 acres of land, which is very conveniently situated at Clarkes Lane, Willenhall, about a quarter of a mile distant from the existing works, and quite close to Short Heath Station on the L.M. & S. Railway. In 1927 it was decided to build an entirely new foundry on this site with the idea of embodying the latest foundry practice as in operation in Great Britain, America, and on the Continent, at the same time having in mind that the maintenance of the high quality of the products was a paramount consideration. For the time being the old plant is being worked to its full capacity, but it is hoped by successive enlargements of the new works, which have been planned for a definite scheme of development, gradually to transfer the whole of the operations to the new site. The buildings at present erected on the new site comprise a power station and two main production bays each 400 ft. long by 45 ft. span, and with a height to the eaves of 21 ft. The building is a steel-framed structure, the permanent walls being brick-panelled. The roof, which has been exceptionally well braced to permit the installation of electric runways in the final scheme, is covered with patent glazing and protected metal sheeting, and, as will be evident from our illustrations, the shops are exceptionally well lighted. The artificial lighting has also been carried out on very generous lines; in point of fact, actual tests with a ft.-candle meter show a uniform intensity of 5/6 ft.-candles on the floor and machines.

Across the centre of the foundry bays is arranged a transporter bay of 18 ft. span, a provision which will enable the whole of the bays being served by the same electric transporter.

The foundry floor is concrete, except for that portion in which the heaviest castings are made.

Fig. 1.—Exterior View of the Foundry Buildings. Messrs. John Harper & Company, Limited, Willenhall.

### The Cupolas and Their Lay-Out.

The cupola platform is 30 ft. by 45 ft., and 16 ft. above the foundry floor-level. A coke storage bin of 50 tons capacity is provided on the platform, as are also bins for the pig-iron, the capacity being equal to the requirements for a day's melt. The coke is raised to the storage bunker 25 cwts. at a lift by means of a special skip, and the pig-iron 20 cwts. at a lift by electric magnet. The platform structure carries a crane gantry having a height to rail of 32 ft. which extends beyond the gantry over the stock yard, and is travelled by a 4-ton crane of the underhung-jib type which, it will be understood, serves the stock yard in addition to its duties of cupola charging. All cupola charges are loaded into drop-bottom skips, weighed on a travelling dial weighing machine and then charged into the cupola. All the handling operations are carried out by the crane. The molten metal is distributed round the foundry by means of an overhead runway.

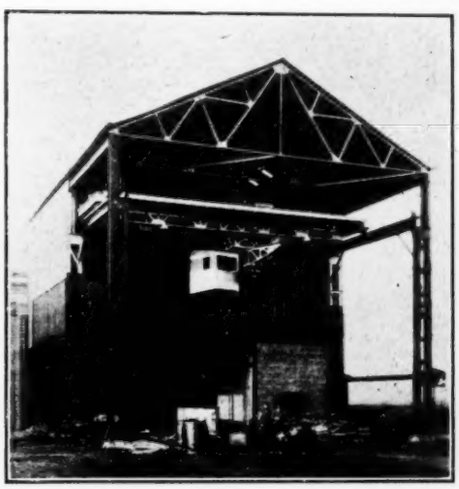

Fig. 2.—Cupola Building and Covered-in Stock Yard.

Fig. 3.—View in the Light Castings Bay. Messrs. John Harper & Company, Limited, Willenhall.

### Sand Preparation.

The facing sand is prepared in a semi-automatic plant which eliminates all intermediate handling. Old sand, new sand and coal dust are each fed into separate hoppers below floor level. These hoppers are fitted with measuring and distributing tables which deliver into one elevator. Sand passes through the various stages and is finally delivered into a finished-storage-bin. The old sand is brought up to the mill in special facing-sand tubs by means of elevating trucks. A compressed-air hoist empties the sand into the old sand hopper, the tubs being then filled with finished sand and returned to the moulders.

Fig. 4.—A Bay for Heavier Castings. Messrs. John Harper & Company, Limited, Willenhall.

All castings leaving the foundry are sand-blasted before being passed to the inspection department. This practically ensures the rejection of all defective castings. Sand-blasting is done on a rotary table which embodies a completely automatic sand-blast apparatus of the pressure type.

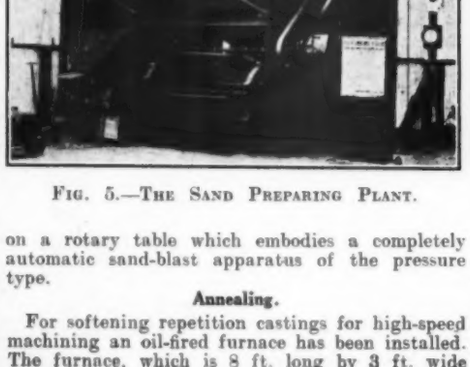

Fig. 5.—The Sand Preparing Plant.

### Annealing.

For softening repetition castings for high-speed machining an oil-fired furnace has been installed. The furnace, which is 8 ft. long by 3 ft. wide by 1 ft. 9 in. high, has a capacity of 1 ton per hour. Fired by a single low-pressure burner supplied with oil at gravity pressure and air at 12-in. w.g., the temperature is under exact control to within 5 deg. C. and a recording pyrometer ensures a record of the temperature maintained for each charge. The furnace is fitted with automatic pusher gear, charging and discharging roller conveyor tables, and handling mechanism. The castings are uniformly annealed free from scale and discoloration.

Two large core stoves are arranged at floor level. The cores are all loaded on racks, which are charged into the stoves by elevating trucks. The stoves are coke-fired and operated on the Plenum system. Temperature recorders are fitted.

The works laboratory was first established in 1913, and additional equipment has been added from time to time in order to aid research and the standardisation of the Company's products. Of special note are the self-contained apparatus for resistance grid castings and the Reichert photo-micrographic outfit, whilst the latest addition is a permeameter for the development of special metal for the electrical engineering industry.

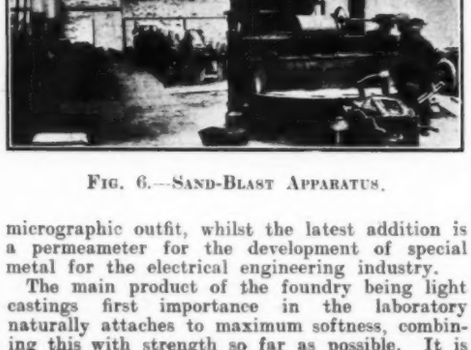

Fig. 6.—Sand-Blast Apparatus.

The main product of the foundry being light castings first importance in the laboratory naturally attaches to maximum softness, combining this with strength so far as possible. It is well recognised that an iron of graphite ferrite structure is essential, and as this cannot be obtained direct in the castings a systematic heat treatment has been developed which ensures the softest structures obtainable in cast irons.

The new foundry has made possible a more complete separation of the various grades of castings made. Special attention is given to resistance grids both in moulding and composition, in order to comply with the strictest demands for uniformity.

For some years the production of cast iron of high permeability has been a special aim of the Company, and constant research on this question is in progress. A licence is also held for non-magnetic cast iron (Nomag), in which castings up to 2 cwt. are made.

Fig. 7.—Annealing Oven for Grey-Iron Castings.

The Company has been associated with the British Cast Iron Research Association since its inception, and has representatives on most of its committees, thus ensuring the fullest knowledge of every development, both in the practical and technical sides of foundry work.

## A Fruitless Effort.

We understand that the laudable efforts of Mr. R. S. Dalgliesh, of Newcastle, the well-known shipowner, to save Spencer's famous engineering works and steel foundry at Newburn-on-Tyne have been fruitless, and his project to keep the works going has failed for want of support. As a result, Mr. Dalgliesh has now sold the High Yard portion of the works to Messrs. Thos. W. Ward, Limited, Sheffield, who last year acquired the extensive rolling mills and steelworks adjoining.

The news will be a great blow to the people of Newburn-on-Tyne, as there were high hopes at one time that the works would be carried on. Even now it may not be too late to save the works, which have steel foundry, forge, engineering and spring shops in working order, and are well equipped for the manufacture of marine shafts, axles, anchors, springs, railway forgings, etc. The works have a great history behind them, and in view of the "Safeguarding of Industry" efforts by the Government, it is a pity that these large works, standing so favourably on the banks of the Tyne, cannot be saved, as it is believed that with the adjoining mills and steelworks, acquired last year by Messrs. Thos. W. Ward, Limited, and with the installation of a new furnace equipment, the whole unit could be brought up to date, without being over-capitalised, as many large steelworks are to-day. There is a great opportunity here for some industrial pioneer.

It is regrettable that Mr. Dalgliesh's well-meant efforts have failed, as with ordinary support, his efforts to carry on the works would have been successful.

Messrs. Ward's intentions are not known at present, but it is understood that dismantling operations will commence shortly, as they are now proceeding with the dismantling of their first purchase.

**European Aluminium Cartel.**—The Association of European producers of aluminium, at their recent meeting in Paris, decided to prolong the agreement for a further three years without any modification.

# Progress in Iron Foundry Work.

At the opening meeting of the Newcastle section of the Institute of British Foundrymen, Mr. Colin Gresty, the newly-elected President, delivered his Presidential Address, of which the following is an abstract.

After thanking the members for the honour accorded him, Mr. Gresty stated that the progress which has been made in our industry in the past has not been of a dramatic or spectacular nature, but rather is the result of the accumulated experience of many years, and the gradual extension of scientific control. Thus we find, without doubt, that those foundries which had the foresight years ago to install laboratories are those which to-day are in the best position to meet the ever-increasing demands of the engineer for castings that will withstand the severe service conditions that obtain, for example, in Diesel engines and in high-temperature steam work. In my opinion, future progress also will be of a "slow but sure" nature, and will depend on bringing under control one after another of the many factors which at present are not fully understood.

For convenience the subject may be considered under the following heads:—(1) Foundry equipment; (2) moulding practice; (3) control of materials and melting practice, and (4) research work.

### Foundry Equipment.

Chiefly due to the mass production of small castings, constant attention has been and is being given to improving moulding machines, sand-mixing and handling plant, and other mechanical devices for speeding up and cheapening production. In the North-East Coast district, where only very few foundries concentrate on small repetition work, there is a danger of such matters not receiving adequate attention on the grounds of their being only applicable to mass-production foundries. Whereas this is certainly true in some cases, it is not always so, and I have seen two or three foundries doing heavy work which have successfully introduced some of the appliances referred to.

The introduction of the sand slinger has opened up distinctly new possibilities for large work, and its use appears likely to extend considerably in the future. Incidentally it requires such large quantities of sand that an efficient sand-preparing plant is really essential.

Another branch of foundry equipment in which much progress has been made during the last few years is that of drying stoves and portable mould driers. It is now recognised that both better and cheaper drying is obtained by using a large volume of air at a moderate temperature than by a smaller volume at a higher temperature.

### Moulding Practice.

Moulding practice, considered apart from machine moulding, is naturally closely bound up with that very variable factor, the human element. It is here that one finds remarkable diversities of opinion as to how any particular casting should be moulded, the best arrangement of runners and risers, speed of pouring and so on. Further, in going through foundry literature, such as the Proceedings of our Institute, one finds countless expressions of opinion on these matters, but a surprising lack of any really systematic or convincing work.

There appears to me to be a wide field for practical foundry research in these directions. If members would bear this in mind and make series of tests when suitable opportunities offer in their work, and then publish the results, there would accumulate in the course of a few years a mass of valuable data from which most probably it would be possible to draw definite conclusions. What is wanted is that the work should be done in a methodical way without any prejudice, so that the results would be proved facts and not theories or opinions. Thus, how much more valuable it would be to talk of runners and risers in actual dimensions instead of general terms such as large or small, and to refer to pouring speeds as so much weight per unit of time instead of quick or slow.

We all know cases where, say, one foundry always runs a particular type of casting from the top, whereas another foundry always runs similar castings from the bottom. What would happen if each foundry used the other's method of pouring, but kept to their own practice in all other respects? Further, in cases of this nature, where apparently good castings are made by both methods, is it possible to prove whether the castings are equally good or whether one method is definitely better than the other?

Returning again to the question of runners and risers, even in the same foundry one sometimes finds a lack of standardisation as between one moulder and another making the same job. Why should not runners and risers be made part of the pattern for ordinary work, as they frequently are for machine moulding, and thus two more of the many variable factors be eliminated? Admittedly such a procedure has its difficulties, but tackled in a progressive way—in the first place by foundries who make their own patterns—I think it would be a step in the right direction.

A considerable amount of attention is being given nowadays to the question of sand and its treatment, as a result of which we may expect our knowledge of this most important foundry material to be considerably increased within the next few years. The successful application of such knowledge, however, will depend on whether rapid and practical tests can be devised suitable for everyday use in the foundry. Whereas fairly elaborate tests can be made on new sand, the chief difficulty lies in the fact that the major proportion of ordinary sand mixtures consists of old sand, more or less denatured. Hence, control of the new sand is not so important as that of the old. At the same time, the problem is one which will have to be tackled because it is one of the factors which is responsible at times for bad castings.

### Control of Materials and Melting Practice.

There is no doubt that the chief advances in ironfoundry work within, say, the last 10 or 15 years, have been on the metallurgical side, and are the results, primarily, of an improved knowledge of the composition and properties of the materials used and of melting practice. The progress made with cast iron has been very real—from a material with a tensile strength of about 7 to 10 tons per sq. in., it has been developed until by the most modern processes tests of from 18-23 tons per sq. in. are regularly obtained as a matter of routine. This is a great achievement, especially when it is remembered that these results can be and are obtained from ordinary materials—without alloy additions—and, further, that they are the product of the cupola furnace.

Unquestionably, the greatest development of recent years is the Lanz-Perlit process, in which the use of very low silicon iron is possible. The heat resisting and other properties of Perlit iron are so well known that it is unnecessary for me to detail them, but I would like to mention one important property which is liable to be overlooked. I refer to the freedom of Perlit iron castings from internal strains—a vital factor in complicated castings which have to withstand heat stresses in service.

Another development in which great interest has been shown and which I think should be mentioned as a further example of practical foundry research is the Emmel process. A few years ago the production of low carbon cast iron (say about 2.75 per cent. total carbon) in the cupola was hardly considered as being within the range of practical politics, and such iron could only be produced in air furnaces or electric furnaces. To-day, however, by the Emmel process this low carbon iron is produced with regularity in the cupola, and has given tensile tests as high as 26 tons per sq. in.

The first essential in the metallurgical advancement of cast iron was, of course, to study its composition and the effect of alterations in the composition on its properties. If progress was to be made the old rule-of-thumb methods had to give way and in many foundries to-day they are a thing of the past. As mentioned earlier, these are the foundries which are able to make high quality iron and, as time goes on, and engineers continue to raise their demands, more and more foundries will, perforce, have to fall into line or be left out of the running for special work.

Professor Turner's classical research on the effect of silicon in cast iron, published over 40 years ago, was the first serious attempt to put cast iron on a scientific basis, but for many years afterwards very little progress was made. Silicon control is still the most vital factor in cast iron but, in itself, it is by no means sufficient at the present day and progress has been such that the other elements, carbon, phosphorus, sulphur and manganese, can now be controlled within narrow limits. The microscope also has been of tremendous value in advancing our knowledge of cast iron—in fact, it is just as essential a part of the equipment of an up-to-date foundry as it is of a steel works.

In spite of the progress which has been made in these directions, however, those of us in touch with the metallurgical side of cast iron realise how little we actually know about this very complex material. Many problems remain to be solved, some of which will be mentioned later.

A natural corollary to the study of the materials was that of cupola practice. It is perhaps unfortunate in some respects that cast iron is so easily melted in a cupola because it has led without question to neglect of the proper study of this type of furnace until the last 10 or 15 years. What were not appreciated in those earlier days were the great potentialities of a cupola worked under scientific control. Instead, a vast amount of time and money was spent on evolving "fancy" types of furnaces, with special shapes and arrangements of tuyeres and other details. This policy is not dead even yet—most probably because of its selling points.

Scientific control has demonstrated, however, that the above-mentioned factors are insignificant when compared with those which really matter, such as the volume and pressure of the air blast, height of coke bed and proper regulation of the charges of metal, coke and flux. It is necessary, as in all scientific work, to bring every possible factor under control—in other words, to reduce the number of variables. Such procedure requires much careful and methodical work and progress is naturally rather slow. Much has already been accomplished, but, even so, there are still many points about cupola practice which are not yet completely understood. As our knowledge increases of such subjects as the reactivity of coke and the effect on the metal of the maximum temperature attained—to mention just two points—factors at present on the list of variables will be brought under control.

The importance of cupola practice is due to the fact that high quality irons have to be made to narrow limits of composition, otherwise they lose their special properties. They are, so to speak, "border line" compositions and differences which do not matter with ordinary iron are vital in the case of special irons. Of the elements present in cast iron everyone will agree that carbon is by far the most difficult to control and, in my experience, success in doing so depends more on cupola practice than on anything else. As is well known to those who buy pig-iron to analysis, carbon control is also the *bete noir* of the blast furnace manager, and it is exceedingly difficult to obtain pig-iron to a specified carbon content unless the limits are wide or one is prepared to pay a stiff price.

### Research Work.

Although much progress has been and is being made with the metallurgy of cast iron, it cannot be said that our knowledge of it is based on fundamental facts or first principles. Instead, as mentioned earlier, it is based largely on experience. The reason for this is the great complexity of the material and particularly the fact that it contains free carbon, the amount, size and distribution of which depend not only on the composition of the iron but also upon several other

factors. Amongst the latter may be mentioned the type of furnace used in melting, rate of cooling (including casting thickness and mass action), maximum temperature attained during melting, and casting temperature.

It is thus seen that taking into consideration only the main constituents of the metal, together with the above points, and ignoring such items as gas content and other elements which may be present in small amounts, the difficulty of controlling research work is immense.

Broadly speaking, there are two main avenues of approach in dealing with research work on cast iron, the theoretical or academic method and the practical method. Recently, in Papers before this Institute and the American Foundrymen's Association, Mr. John Shaw has courageously tackled the problem under the heading of "Theory of Practice in Grey Iron Foundry." He points out that the results of work carried out on material synthetically prepared on a small scale in the laboratory often do not apply to cast iron as commercially produced in the cupola, and he further states that "all the recent advance in cast iron has been founded on a cast iron base, having all the elements present in such quantities as are found in cupola work, of which the work by Lanz, Emmel and Donaldson are examples."

Whilst agreeing in the main with Mr. Shaw's views, I do not think academic research on cast iron should be discouraged in any way, because, although the application of it may not be clear to us at present, sooner or later, as both our theoretical and practical knowledge increase, the two lines of work will join up with advantageous results. It is largely a case of the academic worker being able to take a longer and more detached view of the subject than the research worker in the foundry, who must always keep in mind the commercial potentialities of his work. Further, there are so many points on which enlightenment is required that there is ample room for both.

### Two Classes of Research Problems.

Many of the problems awaiting solution are of a general character, while others refer only to cast iron for special purposes. In the first class may be placed those which bear on the production of sound castings in general, such as the influence of dissolved gases, the formation of graphite, shrinkage, control of composition, melting practice and others which have already been mentioned. The second class embraces those involving special properties in the iron, such as resistance to heat, resistance to corrosion, high strength, good heat conductivity, particular electrical or magnetic properties, and so on. I do not mean to suggest that there is any hard and fast rule between these two classes, but only to indicate that, while many of the problems are of importance to the industry as a whole, others are of interest only to a certain section of it.

Mention should be made of the question of alloy cast irons, to which a considerable amount of attention is being drawn at the present time. For purposes where straight cast iron cannot be made to give the specific properties required, the use of an alloy cast iron may prove successful. On the other hand, I think that the indiscriminate use of alloy additions without proper scientific guidance should be strongly discouraged.

One form of research work which is most valuable with a complicated subject like cast iron is what might be called "mass" or statistical research. By this I mean the periodical examination and classification of large numbers of tests (often running into hundreds or even thousands) such as may be found in the records of the progressive type of foundry laboratory. As a result of such examinations it will generally be found that certain broad facts—not observable from day to day—will emerge which will indicate in which directions future progress lies. Further, this method automatically relegates to the background, or rather to a separate section for special consideration, any uncorroborated "freaks" or exceptions to the general rule.

Research work of this nature is necessarily slow, but it has the outstanding advantage of being built on the surest of all foundations—experience. Incidentally, it shows the great value of keeping full records, even of those facts which may not appear to be of immediate use. Work of this character has been largely responsible for the progress which has been made so far with cast iron, and future progress will also depend upon it to a considerable extent.

In conclusion, I think there is no doubt that the Institute has every reason to be proud of its record in helping to advance the science and art of foundry work. By its many activities it has encouraged workers in all branches of the industry to come forward with their experiences, and has rendered easier of attainment that co-operative spirit so essential to progress.

## Half a Century with One Firm.

### Messrs Ley's Presentation Dinner.

Half a century with one firm without a break, is the wonderful record of Mr. Charles Webb, employed at Messrs. Leys Malleable Castings Company, Derby, and on October 2 the distinguished employee was honoured by the directors of the firm, who gave a dinner in the mess room at the foundry. The gathering was attended by directors and a large number of employees. The celebration was also unique in another respect, as it witnessed the beginning of the business career of Mr. Francis Ley, who is a son of Sir Gordon Ley, Bart., the governing director, and a grandson of the founder of the firm.

There were no fewer than 238 employees present, each with over 21 years' service with Messrs. Leys foundry. The chair was occupied by Sir Gordon Ley, Bart., principal director, and he was supported by Messrs. Ian F. Panton, Francis Ley, E. N. Wood, W. H. Atherton, H. H. Smith, G. E. Allin, W. T. Evans, and W. L. Hill, and Mr. Charles Webb, who occupied the place of honour.

Sir Gordon Ley said it was undoubtedly a very great day for the firm and also to their honoured guest. There was another member of the firm whom they would have been glad to have honoured that day, for he, too, had been with the firm about the same time as Mr. Webb, and 50 years was a long time. Unfortunately, and it was a matter of the deepest regret, that the other gentleman he had referred to had passed away. The directors had decided to honour these two gentlemen by arranging a dinner, but, he added, I am sorry to say that Mr. Keaton died before it could be organised. It was 24 years ago, said Sir Gordon, that he had the honour of occupying the chair at the banquet arranged when the mess room, in which they were now assembled, was opened. On that occasion the firm presented a number of clocks to the employees, and one of the recipients was Mr. Harry Banks, who now, after 45 years' service, was a pensioner and from what he, Sir Gordon, had seen of him, he looked like being a pensioner for many more years to come. (Applause.) There were now with the firm 238 people who had been employed for 21 years or more, and, he said, 225 of those present had received clocks and thirteen others hope to receive them. That says a good deal for Leys.

As far as he was concerned, he began in 1892-3, and, at that time Mr. Webb, whom they were honouring that night had been with them twelve years. He had told the speaker that he well remembered him when he was only a little boy. He has also reminded me too, added Sir Gordon, how hard my father worked in these works in the early days. When the furnace could not be made to go I am told that my father took off his coat, fired three heats and got a record iron. Mr. Webb has never worked for any other firm than this. He had never been out on strike, and had possessed the same domino ever since he had been in the firm. That was certainly a record hard for anyone to beat. (Applause.)

Personally, he was proud, and so were his fellow directors, to have such a splendid man in their employ, and they hoped they would have more men like Mr. Webb. We talked the matter over about Mr. Webb's long service, and thought that after he had worked so hard in the foundry for so many years that we should present him and his wife with two armchairs, so that they could sit and rest in their old age, and also present him with a purse containing golden sovereigns.

Sir Gordon then made the presentation, and in doing so wished Mr. Webb long life and continued good health. He proposed the health of the recipient, which was received with musical honours and cheers.

On rising to respond, Mr. Webb received a splendid reception. He said he very much appreciated the honour they had done him, and thanked Sir Gordon and the directors most heartily for the beautiful gifts. He paid a high tribute to the firm, remarking that he had always been very happy while he had been in their employ, and he thought the conditions under which the men worked were excellent. They could not wish for better employers, and he expressed the hope that other firms would emulate the example of Messrs. Leys. When he began working for the firm he was 18 years of age, and at that time there was only one core maker and one patternmaker. Sir Francis himself used to pass the castings. He proceeded to refer to the rapid growth of the firm and the happy relations which had always existed between the directors and their employees.

Mr. Panton said that the celebration of Mr. Webb's half-century of service coincided with another milestone in the history of Messrs. Leys' Malleable Castings Company. That was the arrival of the founder's grandson, Mr. Francis Ley, who had come to them "to learn his job." Mr. Francis, he said, was extremely lucky in his inheritance, because his forefathers had built up the firm on the basis of co-operation between workmen, staff and directors, so that they all pulled together for the good of the whole firm. (Applause.) On your behalf, he said, I warmly and sincerely welcome Mr. Francis Ley, and I hope he will enjoy his life here, and that he will maintain and increase the good will which has been built up here in the past, and earn the respect and esteem of us all in the same way as his grandfather and his father have done.

Musical honours were accorded the toast, "Success to the Third Generation," and, in acknowledging the compliment, Mr. Ley said that he fully realised the responsibility that would be his in the future, and he hoped to show his gratitude for his welcome, not by words now, but by deeds in the future.

During the evening much enjoyment was provided by contributors to an excellent musical programme.

## Portable Machines for Patternshops.

In the ideally equipped patternshop there would be quite a number of portable machines. There cannot be portable lathes, heavy saws or planes, but the small trimmer that can be moved from one bench to another is now considered almost indispensable, and why the bench planer has not become popular is not understandable. Grinding edge tools is still done on the old-fashioned grindstone that is seldom in good condition, but we saw a portable high-speed grinder recently that would be very useful to patternmakers. It was a light treadle-driven machine, the grinding wheel being horizontal and driven by gearing through a central pillar at a high speed.

A portable saw table can be obtained that fits on a small combination grinder. This saw table is provided with a guide parallel to the saw, and also with an adjustable sliding guide for holding work steady while being sawed, and to obtain any desired angle up to 45 deg. The table can be raised or lowered to get any desired relation between the cutting edge of the saw and the top of the saw table. This is accomplished by means of a large screw with knurled head. Wood can be sawn up to 1¾ in. in thickness. The saw is of 6-in. diameter.

Sanders are also obtainable in portable form. On one type of portable belt sander there is a changeable form pad to allow surfacing of flat or slightly curved surfaces, and the method of operation is as convenient and natural as of a hand plane.

# The Phenomena of Corrosion of Iron and Steel.

By A. Herrero and M. de Zubiria (Bilbao).

(*Continued from page* 241.)

### Causes of Corrosion.

From the foregoing it may be clearly judged that the causes producing corrosion are of two distinct types: (1) Those which are independent of the object which suffers corrosion. (2) Those which are a function of the physical or chemical properties of the object.

The first category includes, of course, those causes due to the surrounding medium in which the material happens to be placed, such as the following: (1) Atmospheric conditions in general. (2) Degree of contamination of the air or of the water by gases such as carbon dioxide which is very easily dissociated, or sulphur dioxide gas which has a very intensive corrosive action. (3) Stray currents from electric circuits of high potential. (4) Contact with other metals or with ferrous metals of different chemical composition (5) Faulty design.

In the second category the following causes may be mentioned: (1) Local differences of composition due to non-metallic inclusions. (2) Deposits, local or otherwise, of foreign bodies. (3) Segregation of metalloids. (4) Internal stresses or strains.

Having stated the causes of corrosion, the authors' work would be incomplete without some illustration of the manner in which the corrosion of iron and steel proceeds, and various typical specimens have been selected for macro- and micrographic examination.

The investigation being confined to the study of corrosion due to atmospheric agency alone, the specimens studied were exposed to atmospheric action after being well polished, contact with drops of moisture being carefully avoided, in order that the action of moist air alone should proceed very slowly, so as to enable the particular effects to be followed step by step and the practical results to be noted at the proper moment. All the specimens were subjected to precisely similar tests.

Thus, for example, Figs. 1 and 2 show that a strained steel, owing to an improper thermal and mechanical treatment, corrodes with much greater intensity than a similar steel that has been perfectly annealed (see Figs. 3 and 4). In Fig. 2, in the material after corrosion appears the banded structure which the original steel possessed (Fig. 1), while in the annealed steel, shown in Fig. 3, the corrosion, illustrated in Fig. 4, is much less, very much localised, and without any particular orientation.

It is evident that a sorbitic steel subjected to the same test, which when unstrained has a structure of the smallest grain-size, shows the same type of corrosion as the annealed steel, but of less intensity. Fig. 5 is a micrograph of the sorbitic steel in its original condition, and Fig. 6 shows it in the state of corrosion.

It may be concluded from these examples that improper mechanical hot-working, producing strains, or excessively large crystals, due to prolonged annealing, should be avoided if it is desired to reduce the effects of corrosion. Of the two defects strains are of much the more decisive importance.

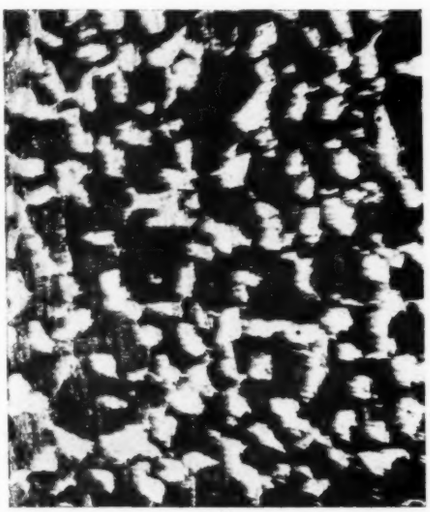

Fig. 3.—Annealed Steel. Etched with Picric Acid. × 120

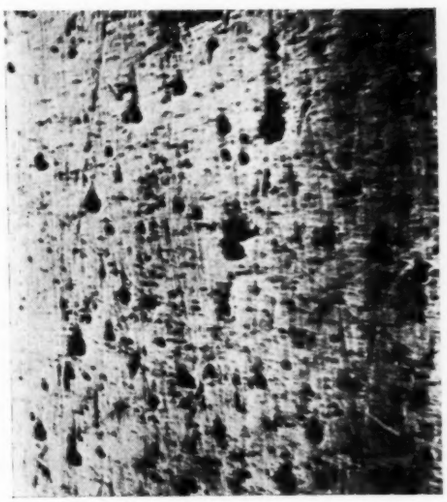

Fig. 4.—Same Specimen as Fig. 3, after Corrosion. Polished only. × 120.

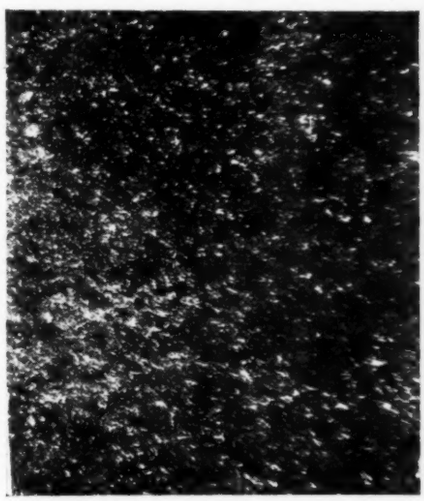

Fig. 5.—Sorbitic Steel. Etched with Picric Acid. × 120.

Fig. 6.—Same Specimen as Fig. 5, after Corrosion. Polished only. × 120.

Fig. 7.—Steel with many Slag inclusions, after Corrosion. Polished only. × 120.

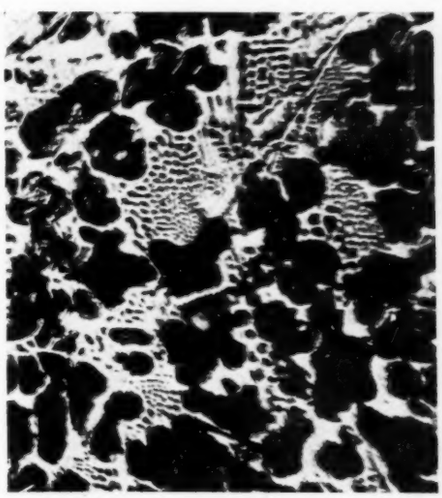

Fig. 8.—White Iron. Etched with Picric Acid. × 120.

Fig. 7 shows the effect of the corrosion of a steel with many slag inclusions drawn out in the direction of rolling, and the conclusion is reasonable that with this orientation, prone to corrosion as previously noted and stimulated by the presence of non-metallic inclusions, the corrosion becomes rapid and intense. This shows up the necessity of avoiding everything that might lead to the formation of non-metallic inclusions, though in some cases these are the inevitable consequences of an elementary process of manufacture such as puddling, but in other processes they form serious defects which should be remedied, not only on account of the corrosion which they promote, but because they affect the mechanical properties, which question, however, is outside the subject of the present paper.

The presence of sulphur in iron and steel always stimulates intense corrosion. This is evident from Figs. 8 and 9, which are micrographs showing a white iron and its appearance after corrosion. The first micrograph shows the eutectic of iron and sulphide of iron clearly defined, and the second the degree of corrosion attained.

Fig. 10 represents the result of the corrosion of a rail, the only cause which has stimulated corrosion being the marked segregation of sulphur, as brought out clearly on the corresponding macrograph, Fig. 11. The intensity of the action of sulphur in activating corrosion will be noted.

Micrograph Fig. 12 likewise affords evidence of an important occurrence in the manufacture of certain products, such as plates. The striations, however small they may be, exert a radical influence, owing to their forming zones of corrosion and thereby promoting it, as was pointed out in discussing electro-chemical phenomena. Care should therefore be taken to use hard rolls, perfectly true, and well polished. This point is of the greatest importance for any structures exposed to sea-water.

**Means for Moderating the Effects of Corrosion.**

Once the causes producing corrosion are known, it becomes possible to consider the remedies that may be applied to avoid it or restrict it within limits. Concentrating first on the external causes, it is outside our power to alter the atmospheric conditions, or to prevent contamination of the air by carbon dioxide or sulphur dioxide gases, which necessarily abound in metallurgical works on account of the combustion of fuel on a large scale therein. Preventive action can only be taken to meet the cases set forth in regard to (1), the attack by stray currents of high potential, (2) attack due to the use of metals of different chemical composition; and (3) attack due to defects in design. With regard to (1) and (2) it is difficult to find an efficacious remedy; for example, in the case of the metal supports of the transmission lines of high-tension electric current, leakages of current, due to defective insulation, are not infrequent, and are difficult to prevent. Likewise in the manufacture of machinery, contact between different metals giving rise to corrosion is inevitable.

With regard to defective design, it has repeatedly been found that in a steel structure the main components have for the most part been perfectly calculated to withstand the mechanical stresses which they are intended to bear, but that by some error certain principal members have been miscalculated, with the result that the material in parts is stressed beyond its elastic limit. Under such conditions the parts so stressed, which may be very important members of a framework, are highly liable to corrode even though the remainder may remain normal, and thus the stability of the entire structure may be impaired. It has happened that the whole structure has had to be taken down and replaced through failure to recognise this danger.

It has also happened in the case of a structure perfectly designed from the point of view of resistance to the mechanical stresses that rainwater may accumulate in hollow spots and remain a long time without draining off, and if such spots are not easily accessible it may not be easy to keep them properly painted or remove any coating of rust which may have formed on the steel structure. All such cases show the importance of the study of corrosion from the point of view of safety, and how the rusting of a small and insignificant part may lead to the destruction of the whole structure.

Concerning the general atmospheric conditions, it is evident that a moist air and persistent exposure to rain with strong aeration are agents which particularly favour corrosion, since both the electrolyte and influence of oxygen then come into action.

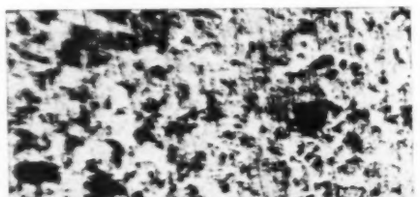

Fig. 9.—Same Specimen as Fig. 8, after Corrosion. Polished only. × 120.

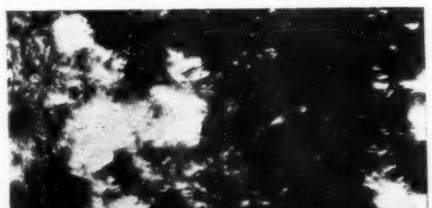

Fig. 10.—Specimen of a Rail after Corrosion. Polished only. × 120.

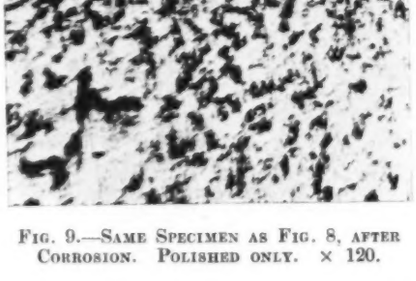

Fig. 11.—Sulphur Print of the Rail Steel shown in Fig. 10, after Corrosion.

Fig. 12.—Corrosion in a Plate Steel, with Striations. Polished only. × 120.

If to these conditions be added that of proximity to the sea, bringing with it air laden with sodium chloride which increases the conductivity of the electrolyte and consequently accelerates the corrosion, it will be readily understood that the metallurgical works of Vizcaya are unfortunately exposed to a combination of all the circumstances most apt to produce intensive corrosion due to external causes. The industrialists of Vizcaya are only too well aware of this trouble in their district. Nevertheless, since the same disadvantages are prevalent in nearly all British and American ironworks, and in many works in Germany, it may be said that the trouble is universal and is inherent to the conditions under which the metallurgical industry is carried on.

With regard to the internal causes which stimulate corrosion, it has already been indicated in what direction the remedy should be applied in each case. Proper heat treatment and mechanical treatment, the elimination of impurities and avoidance of segregations, are the principal objects to aim at to obtain improvement. All non-metallic inclusions contained in steel, whether gaseous or solid, are impurities and defects which need never be present if sufficient care be taken in the manufacture of the steel, and the same applies to surface deposits of foreign substances.

It is undeniable that a suitable heat and mechanical treatment will remove strains from steel, and it is equally true that the removal of the segregating elements, sulphur and phosphorus, particularly sulphur, will improve the rust-resisting qualities of the metal.

The authors emphasise with genuine satisfaction, both as Spaniards and as promoters of knowledge on this subject, that their metallurgical works are fully equipped with all the elements of precision for the study of any problem which may arise within this field.

Finally, if the statements in this Paper on the subject of corrosion should serve as a means of inducing both the scientific gentlemen among the members who honour us with their visit, and our own scientists who have specialised on the subject, to exchange the results of their latest studies, the authors will consider that they have achieved their principal ambition in presenting this Paper.

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The public examination of Mr. G. J. Osborne, engineer, of 69, Meersbrook Park Road, Sheffield, will take place on October 18 at the County Court Hall, Bank Street, Sheffield.

## Exceptional Rate Policy.

### The Railways' Developments.

By J. W. Parker, A.M.Inst.T.

Scarcely any aspect of rail transport is of greater moment to the trader than the subject of exceptional rates, those reduced figures which so often are responsible for substantial reductions in carriage costs. The formation of a policy in connection with these figures, or what may be more correctly described as the adaptation of the companies' circumstances to changed conditions, is thus necessarily a matter of more than passing interest.

It will be remembered that prior to the extensive changes which came about at the beginning of the year, the railways had always been free to reduce freight charges to any degree necessary to secure business, but the raising of such rates was a matter of great difficulty. Under the new rates system, with its recognition of the railways' authorised revenue as a foundation of the financial scheme, there were obvious difficulties in the continuance of unlimited freedom towards lowering rates, as if unduly low quotations were made it might be impossible to attain the authorised receipts. To safeguard the position, the railways were prevented from granting exceptional figures which came more than 40 per cent. below the corresponding ordinary rates, such quotations only being possible if approved by the Railway Rates Tribunal. The restriction, however, did not end here, but for different reasons it applied at the other end of the scale. Through it rates within 5 per cent. of the normal were not allowed without authority. It was agreed that charges so close to the ordinary could be discontinued without appreciable loss by the railways or their customers.

Whatever this may have been in theory, it quickly failed when put into practice, because the companies found it impossible to frame useful exceptional rates within the limits of the 5 to 40 per cent. of the ordinary charges. In a word, the new restrictions made rates altogether too rigid particularly when the competition of road and water transport was taken into consideration. Unhampered by any fetters of this kind, these two means of transport were successfully resisting all the attempts of the railways to win back the traffic previously lost.

#### Increased Traffic and Fixed Charges.

Following upon a close investigation of the tonnage passing by road and the charges being made, the railways came to the conclusion that they would have to offer rates 50, 60 and even 70 per cent. below the ordinary before they could hope to regain their lost carryings. Before their investigations were completed the 5 to 40 per cent. restriction came into effect. This meant the proposed reductions could not be brought into use until the Tribunal had examined them and been convinced of their necessity. As a means to this end, the companies considered a staple commodity in one locality, 80 per cent. of which was travelling by road, against 20 per cent. before the war. They were able to show that all the trains which ran when they carried the bulk of this traffic were still running, and that their expenses for permanent way, stations, staff, etc., remained practically the same, whether they carried the extra goods or not. The position then was that any rate which covered the actual expenses of movement and made some little contribution towards fixed expenses was justified, as it assisted the annual revenue, and this being the Tribunal's primary responsibility, that body felt bound to allow the figures.

Having established this principle, the railways quickly applied it to a large volume of varying traffic throughout the country, in fact, wherever freight passed in "streams" between any two points, the railways were prepared to put forward "cut" quotations in the hope of securing the traffic. For the most part their efforts were directed against road transport, but in some instances they had the competition of coastal shipping in view. The ports on the North-East Coast, the Bristol Channel and South Wales were some of the districts concerned, whilst in others rates were reduced for traffic between Liverpool and Glasgow and the districts adjoining each of these ports. In the case of certain iron and steel goods on the North-East Coast, a "cut" figure was given to enable a firm to compete with the foreign undertaking, and in this instance the Tribunal accepted a quotation on national grounds.

The necessary elasticity having been obtained on the 40 per cent. side, the railways found it desirable to press the 5 per cent. limitation, since it was found to be detrimental for such commodities as fuel, cement and other low-grade materials. On this point no single cause can be selected. For some goods the small increase was sufficient to upset carryings, and it became necessary to institute rates 2 and 3 per cent. under the ordinary. In the matter of coal and coke rates, a penny or two in the quotations was found sufficient to turn contracts from one firm to another. Cases were found where adjoining stations had an identical rate to a common destination last year, but the few miles separating the two were enough to bring a new standard rate within 5 per cent. of the old exceptional charge at the nearer place, but outside the limit at the further station, with the result that the exceptional figure at the nearer place had to be cancelled. The practical effect was an increase in rate of 4 per cent. to the trader in one place, whilst his competitor further away continued to enjoy the old figure.

Such a state of affairs naturally demanded the restoration of equal treatment, which in all cases was conceded. Another cause was where a long-term contract had been entered upon when last year's rates were in force, and at the institution of the new charges several thousand tons remained to pass which automatically became subject to higher figures. In these circumstances the only fair thing to do was to reintroduce the old figures until the expiration of the contract.

#### Pre-tribunal Freedom Restored.

It will be seen that although the causes of the 5 per cent. limit being waived differed from those in connection with the 40 per cent. boundary, the result to the trader is the same, as it really means the old-time freedom is restored. It appears as if very low quotations will continue to receive the approval of the Rates Tribunal so long as the railways can show that the figures make some contribution towards their net revenue, hence the rail user does not stand to lose. The development is, in fact, an intensified use of the railways' best competitive weapon—the reduced rate.

There is one aspect which should not be overlooked, since it concerns the railways' newly-granted authority to raise exceptional rates which come within the 5 to 40 per cent. limits. Provided the quotation is given voluntarily by the railways, they may increase it by giving notice, but if it has been fixed by the Tribunal, only that body can alter it. The intention behind this proviso was to encourage a bolder attitude on the part of the companies towards lower figures. Previously they were sometimes deterred from making experiments by the fear that if any particular rate proved a failure they could not easily withdraw it.

As yet the operation of this phase has not been tested, because unusual circumstances have forced the railways towards a charging policy in some respects bolder than was anticipated. Nevertheless, one should not lose sight of the fact that moderately low exceptional rates granted by the railways themselves are now liable to be withdrawn should the companies be dissatisfied with them.

## Change of Name.

The Ohio State Foundrymen's Association, with headquarters in Cleveland, has changed its name to Ohio Foundries Association, Inc., having been incorporated under the new name. The Association felt that a name should be chosen that would be more distinctive of the Association's real status, as it is an organisation of foundries rather than of individuals, as the old name might indicate.

The unfilled orders of the United States Steel Corporation on hand at the end of August amounted to 3,624,000 tons, compared with 3,571,000 tons at the end of July, and 3,196,000 tons at the end of August last year.

## Hydraulic Method of Cleaning Castings.

In an editorial we recently referred to the above subject after a visit to the Lanz Works at Mannheim. Further information has been made available by the *Iron Age* in a report of a meeting of the New England Foundrymen's Association at Boston, when Mr. James Prendergast and Mr. H. A. Lincoln, respectively foundry superintendent and works manager of the Sullivan Machinery Corporation, Claremont, New Hampshire, set out their experience in the following terms:

"The layout of our plant, with river running alongside and a basement under the cleaning room, lent itself perfectly to the installation of a hydraulic process of cleaning castings. We installed the equipment in the basement under the floor of the cleaning room. We lower the castings down into this room through a hole in the floor. The floor of the hydro-blast room is raised high enough from the basement floor to allow the water, after use, to drop 12 ft. and flow back into the river.

"We took advantage of the distance the water dropped to wash the fine burnt sand. It is possible for us to reclaim the clean sand. The agitation of the water accomplishes this without the use of mechanical aid. By a simple arrangement the water and sand cleaned from castings rushes through a hole in the floor through a screen which catches rods, nails and large pieces of core, then through a trough arranged to reduce the speed of the water flow. Agitation is arranged for to cause the fine-burnt sand to separate easily as it passes down to a finer screen. This second screen of 50 mesh holds the sand we wish to reclaim.

"As the sand to be reclaimed accumulates, it is forced by the flow of water through a small slot into a space divided in the centre to direct this sand to two spouts directly above dump buckets. These buckets have numerous screened holes to allow the water to escape. The unclaimed sand with water is discharged into the river.

"The sand in the dump buckets is allowed to stand over night, and is used the next day in facing sand for side floor, bench and machine moulding. No new sand is used with the reclaimed, but simply an addition of ordinary fireclay and the regulation amount of sea coal. The mixture is worked up in the usual manner. Sand costs 25s. a ton, delivered Claremont, consequently the saving is worth while."

Cores running in size up to 9 × 18 × 66 in. are cleaned out by this method. The flow of water in the process of cleaning castings is delivered at 300 lb. pressure through common fire hose with ¾-in. nozzles. The only cast involved in operating the cleaning outfit is that of running a 100-h.p. motor on the pump.

This method of cleaning castings has relieved the company of the hardest labour problem it had to contend with. The labour turnover on the old method of cleaning castings was very high, but now it is practically eliminated. Accidents due to flying fins and sand are done away with. Uncleaned castings and large sand piles, due to the inability to secure men to do the work, causing congestion on the cleaning floor and delayed deliveries, are a thing of the past. Cores are cleaned more thoroughly than ever before, said Mr. Prendergast, and consequently the machine shop is relieved of a lot of unnecessary work. The hydro-blast, however, does not do away with sand blast, but it does lighten the task of the sand-blast operator. One operator takes care of all the work, making a saving of five men. The power cost is approximately 10s. per day, and the saving of sand is 17 tons per month. Best of all, the speaker added, working conditions are satisfactory.

Mr. Lincoln went into more detail as to savings in operating costs and costs of installation of the hydro-blast equipment. He pointed out that the installation of such a system in foundries not having a river handy or low city or town water rates is out of the question, but added that, where an installation can be made, it is the most practical method of cleaning castings.

# Electricity in the Modern Foundry.

By C. H. S. Tupholme.

The method of protecting electric lighting and power circuits by means of fuses has several disadvantages. In the first place, the fuses may not all be grouped together, and some minutes will be spent in finding which fuse has "gone." Secondly, the fuse must be removed and replaced, or new wire must be found, and, unless the foundry is well organised, the chances are that whoever had the fuse wire last forgot where he put it. These and other disadvantages of the ordinary fuse are obviated when a circuit breaker is installed, which, on an overload, merely trips open, and can immediately be reset, thus saving any delay in the restoration of lighting or power services.

These circuit breakers, or urelites, are, in effect, electric safety valves, and protect the electric circuits by automatically opening in the event of an excessive flow of current. They do what fuses do but without the attendant expense or trouble. When the urelite is opened by an overload, it does not require the insertion of renewal parts, but by a twist of the wrist is instantly reset.

From the mechanical point of view, these circuit breakers, which are of the well-known ITE type, have two poles, each of which consists of a switch for closing and opening the circuit, combined with an electromagnet which is responsive to the flow of current and opens the switch when this current exceeds the amount predetermined as safe. The entire structure is mounted in a steel case, upon the front of which is mounted a handle for closing the circuit breaker one pole at a time, and also a push knob for opening it manually.

These circuit breakers can be adjusted easily to open at any desired current throughout several ranges, the setting being indicated on a scale. This adjustment depends upon the relation of the overload tripping magnet and its armature, and is not subject to accidental variation. This adjustment can only be made with the case removed from the breaker, so that it is not subject to unauthorised changes when the case has been replaced and locked. This positive setting of the breaker is another feature which recommends it in place of the fuse. The ordinary fuse is not reliable in that its blowing point may be variable, and in any case is not subject to adjustment. The writer has known of cases where to save continual blowing of fuses, owing to overloading of the circuit, men have replaced the proper fuse wire with other of a heavier type, which is a dangerous practice and may well lead to damage to the electric apparatus since it dispenses with the proper function of a fuse, *i.e.*, to constitute a weak point in the circuit, so that any rupture of the system due to overloading can instantly be traced.

Circuit breakers of this type are, of course, made in various types to suit most if not all conditions. The simplest form is the ordinary overload instantaneous trip, which opens the circuit instantly upon the occurrence of excessive current. This action is controlled by an overload feature, the principal parts of which are an electromagnet, a pivoted armature which works with it, a movable stop for adjusting the relation of the armature to the magnet, and a calibrated scale indicating the current values corresponding to the respective positions of the armature.

The electromagnet is energised by the current flowing in the circuit. When the conditions are normal the armature rests at a distance from the magnet on an adjustable stop which determines its position. When the current exceeds the value for which the armature has been set, the latter is forcibly drawn into engagement with the magnet, toward the end of which movement it strikes and releases the latch which has hitherto held the switch member of the breaker in the closed position, allowing it to be driven forward by spring pressure into the open position, thus rupturing the circuit.

In many cases, however, there are conditions where heavy momentary overloads are quite usual and the continual tripping of a circuit breaker upon any and every overload would be a source of annoyance. In such case it is as well to incorporate a direct-acting time limit feature, which is a device for limiting the continuance of the overload, whatever its magnitude, to that period of time for which it may safely be carried. Obviously, the heavier the overload the more quickly must it be interrupted. In the standard ITE circuit breaker, this feature constitutes a time limit device in which the magnetic energy produced by the overload is applied directly to open the circuit without the intervention of relays or other intermediate devices.

### Supply Breakdown.

In some cases, whether power is derived from a private generating plant or from a public supply, the current has been known to fail without warning. In such cases, if the electrically driven machinery is left in the running position, much damage may be caused by a sudden restoration of power supply, and the writer has known of serious injuries caused through motors being left in circuit when the supply has failed, and then suddenly starting up again.

Such a condition may be prevented where these breakers are used if a no-voltage feature is incorporated in the design, and this feature is certainly to be recommended. What it does is to open the breaker automatically in case the voltage of supply falls unduly below normal or fails entirely.

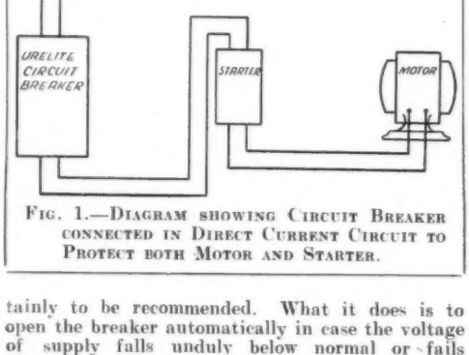


Fig. 1.—Diagram showing Circuit Breaker connected in Direct Current Circuit to Protect both Motor and Starter.

There are numerous conditions of service which may render it desirable to have means available for automatically opening the urelite breaker independent of load conditions, and these conditions may be met by having a shunt trip fitted.

This shunt trip consists of a tripping magnet and armature provided with an energising coil of numerous turns and high resistance. The coil is normally out of circuit, but is adapted to be brought into circuit either across the line or into an independent circuit, by means of a small switch operated either by hand, or automatically upon the occurrence of some predetermined electrical or mechanical condition. When the magnet is thus energised it attracts the armature, and the resulting movement opens the circuit breaker. A small auxiliary contact member is provided in the breaker so that in opening, the shunt trip coil will be disconnected in advance of the breaking of the main circuit. By this means the coil is protected from inductive discharges to which it might otherwise be subjected in the event of the breaker being opened while carrying a heavy current. By the use of the shunt trip feature any number of breakers may be opened simultaneously.

### Ringing Bell Denotes Breakdown.

A useful device to install on one of these breakers is a bell ringing feature, which rings a loud bell when the contacts of the breaker are forced open for any reason whatever, thus instantly calling attention to the fact that the circuit is interrupted. The bell can, of course, be placed in any position, so that, while the circuit breaker may be situated in a separate room, the bell may be placed in the most convenient position at any distance from the breaker.

Obviously, the initial cost of these circuit breakers is much more than that of fuses, but they will, in the long run, prove well worth their price, when it is considered what protection they afford the men, the motors and the driven machinery, as well as the money they save through obviating long delays while new fuses are installed.

# The Copper Scrap Shortage.

By "Onlooker."

For the greater part of the present year it has been evident that reserves of copper scrap were dangerously low, and only the fact that consumptive demand was spasmodic and largely hand-to-mouth prevented it from becoming too notoriously obvious. Manufacturers were certainly aware that contracts took longer to complete, and that unless they made a point of keeping a large tonnage on their books it was impossible to be certain of securing sufficient raw material in scrap form for their foundries. This necessity of having an increased quantity of copper at risk was not altogether desirable, but it was a case of Hobson's choice, and since the history of copper values this year has been a tale of rising values, this policy has not turned out badly for users.

The recent strength of copper as shown by quotations on the London Metal Exchange has precipitated heavy buying of refined metal, consumers throughout the world all rushing to buy at the same time. In a similar manner, but without the publicity which is accorded by a daily summary of events on 'Change, consumers of copper scrap took alarm and bought up all the tonnage they could lay their hands on. The immediate result of this has been to show up with startling clarity the emptiness of the old metal reservoir, and prominent dealers have been obliged to refuse business on the plea that they could not see where scrap was to come from. Twelve or six months ago even a rising market would have brought out plenty of scrap for sale to consumers as cover against orders received, for although some interests will always "sit on" material until the rise has spent itself and buyers are satisfied, there have always been plenty of merchants fully alive to the fact that sales must be made while the demand is in evidence.

It is quite possible that a certain amount of scrap is being held back in the hope of greater profit later on, but the tonnage is probably insignificant and unlikely to affect the situation or prices in any way when it is finally released. More often than not over-anxious holders watch the market up to the top and half-way down again before they can make up their minds to part with their holding. Judging by the tonnage of condemned stores disclosed on the forms of tender issued by the railway companies the normal reserves of scrap copper are very low, and this theory is borne out by the situation at the railway metal sheds, where the tonnage looks very lean indeed, and material no sooner arrives than it is inspected by an eager buyer and passes into consumption. The same thing may be said of scrap dealers' warehouses up and down the country, for the recent wave of buying emptied them, and the problem now is, how are they to be filled again?

Scarcity of scrap in this country has compelled our dealers to seek supplies abroad, and sales in France, Belgium and Holland have been attended in the hope of picking up parcels at a reasonable figure. The bulk of the material has, however, gone to Germany at prices which manufacturers in England would fight shy of, but which their competitors across the North Sea seem able to afford while underquoting on the finished product.

The present situation is serious, and looks like becoming more difficult yet, for American shipments of old copper to Europe are likely to be considerably curtailed during the ensuing months owing to the scarcity of scrap in the United States. This development in the situation is worthy of every attention, for hitherto there has been enough scrap and to spare across the Atlantic, and its export to Europe has staved off famine conditions over here. To many factories scrap is an absolute essential in these days of reduced rough copper production, and, at the same time, manufacturing profits can only be maintained provided that scrap is purchased at a reasonable figure. A shortage is already apparent and prices have advanced, but should the shortage become acute, and there is quite a chance that it may, scrap values would climb very rapidly.

# Waster Castings.

By Horace J. Young, F.I.C.

A recent leader in this Journal dealt with the case of a firm of pig-iron manufacturers who stated in a circular that in their own small foundry they had but one waste casting during the past three years. The leader went on to say that this announcement had caused some consternation among foundry owners, and that some had sent for their managers and foremen to inquire why they make anything from 5 to 15 per cent. of bad castings.

It is a common saying among foundry people that the foundry which makes no bad castings makes none at all. Working upon that assumption, it would seem likely that the firm making one bad one in three years might merely have made its replace and naught else. On the other hand, there are other aspects to be taken into consideration. The writer has seen more than one foundry where none of the castings was good, but, poor as they were, they were good enough. A fairly good athlete might be able to jump six feet high 99 times out of a 100, but fail 15 times in every hundred to jump another inch higher. A better athlete might hardly ever fail at 6 ft. 1 in., but might have many failures at 6 ft. 2 in. Hence it all depends against whom he is matched as to whether he comes out top of the list or bottom. In other words, one cannot judge anything without having something with which to compare it.

If the owners of foundries collected all the literature setting forth the merits of special pig-irons they would be able to approach their foreman and say: "Use this and our troubles are over for ever and a day." But does it not depend upon whether they wish to jump six feet or higher?

That foundry owners should be astonished by this one particular statement is more astonishing than the statement itself. There is a cupola flux advertised which claims, among other things, to give hotter metal. This miracle causes no consternation nor, so far as the writer is aware, does it prevent the sale of the flux to any greater extent than it warms the metal.

### Pig-Iron Buying and Waste Percentage.

The consultant in foundry work gets an insight into the mixing of iron in the foundries of this country. The British Cast Iron Research Association, rightly or wrongly, came to the conclusion that the *selling* of pig to analysis was unwanted. Whether the true answer to this is that they did not think that the foundryman would *buy* to analysis was not made clear. The fact remains that it is one way whereby progress is possible. No matter whether a foundry is using common pig, first-class pig or refined iron, the control of composition is vital to the final result. For instance, one purchases a good Scotch iron with a certain carbon and manganese content. The results are excellent for the purpose, but the next consignment of the same brand has a different composition with its inevitable effect upon the castings either in their appearance, their perfection or their results in service. In certain work it is worth while using refined iron. To use it if its composition varies is absurd, and it is hardly less absurd to use it when the composition of the other components of the mixture are varying. Some people strive to overwhelm the argument by saying that special irons possess properties unaccounted for by their compositions. That does not affect the position. One particular iron may possess properties of running cleanly and giving a good surface to the casting, but it does not alter the fact that other of its properties will vary, as and when its carbon, silicon, phosphorus, sulphur or manganese contents vary.

Get the right irons of the right composition to suit the particular castings, the particular method of making them and the particular service which they need to stand up to, and many metallurgical troubles disappear to reappear only if the cupola practice is faulty or the control of the composition is lax.

### Wastage of Good Material.

Not long ago the writer saw a foundry making a special cast iron and throwing the heads, gits, etc., on to the main scrap head; indeed, the only scrap heap they possessed. The result was twofold. Firstly, they were wasting refined iron—iron refined by themselves; lastly, they were using this valuable scrap in ordinary mixtures to the detriment of the castings concerned. It was a matter of composition, but the foundryman argued that "it was a bit of good stuff." It was a bit of good stuff in the wrong place.

Speaking of waster castings, the writer came across an interesting case some time back. He was called in to inquire into the workings of a foundry which was making a financial loss. Some 50 tons weekly was the output, and wasters were down to under 6 per cent. The castings were very rough, and the iron was poor. The answer to the problem was perfectly simple. They used all their castings themselves, and although some of them were large pieces there was remarkably little machining, just a flange or a bolt-hole here and there. The wasters would have been probably 75 per cent. had those castings been machined all over. Had they been required to be hydraulic proof there would have been no good ones at all save by luck. Still, the castings were good enough for the purpose. The reason why the concern was a failure financially was that they were using expensive irons when cheap ones would do as well, and, as it proved, even better. They were using too much coke and getting cooler metal than less coke, properly applied, ultimately gave them; they were extravagant in unskilled labour and in overtime.

### A Vital Figure Missing.

In one particular case the writer spent some months of hard work "getting at" the following figure. *The amount of raw material, namely, metal of all kinds, going into the cupola to produce one ton of good castings.* When that figure was finally and conclusively proved, it threw light upon the foundry's inefficiency as a financial asset, and showed that the foundry had been run upon wasteful lines. Moreover, that same figure showed that they had never known *the cost* of producing one ton of good castings, and, therefore, their quotations had been based upon false assumptions. The writer has met with the argument that the figure does not matter. A little reflection will show, however, that it is a figure of importance to the final costing sheet. Suppose a foundry is melting two tons of metal to make one ton of good castings; it means that two tons are being purchased, stacked, moved to the cupola platform, melted with coke and limestone (which also need to be purchased and moved), carried to the moulds after consequent melting and tapping losses have occurred, poured, provided for so far as space is concerned; handled, and the surplus taken to the scrap heap, and, finally, back to the cupolas—all this to produce one ton of good castings. Another foundry making a similar article may be doing it on 1½ instead of two tons, and it takes little financial instinct to see that the one foundry may pay a profit while the other may not. It affects the consumption of raw materials, and the costs of both direct and indirect labour to a vital degree. Finally, as already stated, it is impossible to quote accurately unless the figure is shown on the costing sheet. Speaking from his experience round about the country, the writer would predict that the average foundry does not know this figure. Of course, from one class of trade to another the figure will vary enormously, but it should not vary much in any one class.

Another foundry, which had peculiar interest for the author, was where the foreman is using scientific methods without putting up the labour costs. With every apology he showed his pig-irons stacked consignment by consignment—not brand by brand; his scrap graded into the three classes of cast iron that he made, plus another heap of "outside" scrap. With equal humility he showed every mixture being weighed out on an antique machine and the coke and limestone being measured in baskets. Marvelling, the writer asked him how he managed to afford the labour. His reply was historic, for he said, "Bless you, it doesn't take any more labour to do it properly, it keeps the men busy, and it keeps me right." Moreover, he was amply repaid; his results were excellent and the uniformity of his metal as seen in the machine shops was an object lesson. He went on to say that he had never struck a "bad patch" over many years of working until the miner's strike, when the coke let him down, and he concluded by saying that if only he could get his irons analysed how much better he could do. Without encouragement, that man is doing everything possible to procure uniformity and accuracy, and doing it without spending one penny extra. As a matter of fact, it was the author's task to go through their books, and the foundry was one of the most economical he has met.

Nearly every foundry claims to have remarkably few waster castings. No matter where one goes this appears to be the cry. In high-class work, like internal-combustion engineering, the foundry which is making no wasters is not making progress. Every waster is a casting one can investigate; the metallurgist can examine it from his point of view, the foreman from his aspect, and the two together will get that foundry a little further along the right road with the help of a waster.

Unless, however, the foundryman and the metallurgist co-operate; unless each respects the other's knowledge and methods, nothing will be gained. If the foundryman thinks he knows as much as the metallurgist he is better without one; if the metallurgist thinks he knows as much as the foundryman he will be valueless. Neither knows the other's job, neither has the other's training and experience, neither can direct the other's work. But the two can work together and if both are trying genuinely to arrive at the truth there will be good results.

Good castings are not due only to good moulding any more than they are not due only to good metal. Both moulding and metal play their parts. Often the moulding is so good that a fair job is obtained in spite of the metal. At other times the whole of the moulder's skill is useless because of unsuitable metal.

### Recent Advances.

The foundry catering for the latest advance of engineering will need to reconcile itself to some waster castings. Where perfection of casting *plus* perfection of metal are required the price of the job must include the possibility of failures, due either to bad castings or bad metal. Whilst almost anyone could make a good Diesel cylinder of ordinary iron, few can make one of the iron necessary to withstand the working conditions. And it is getting more difficult with every year that passes. The engineer is asking of our metals about as much as they will stand.

The author is no longer intimately connected with the Perlit process, but looking back over many years of ironfoundry work he sees two big advances which have come about in his time. Firstly, the production of cast iron of uniform quality through the control of cupola-practice and of composition; and, secondly, the Perlit process. If a foundry does not like working to composition, if it does not like or does not need the Perlit process, there is nothing for it but to proceed upon the old lines. Alloy irons will come, but have not come yet, and even when they do they will fall either under control-of-composition or under Perlit procedure—the latter, of course, involving the former.

Talking of wasters; let the foundry that never has any, cast a piece twelve inches in diameter, so that when it is machined all over it will be grey, all-pearlitic, and of equal Brinell density *everywhere*, be free *entirely* from flaws or patches of "openness," and be two inches finished thickness. Some simple-looking castings present greater snags than complicated ones, and it is a pity we do not hear more and not so little about waster castings.

## French Foundrymen's Association.

The seventh congress of the Association Technique de Fonderie is to be held, as previously announced in The Foundry Trade Journal, on Friday and Saturday, October 26 and 27, at the Ecole Nationale d'Arts et Métiers, 151, Boulevarde d'Hôpital, Paris.

The first session opens at 10 a.m. with a speech by Mr. Luc, Co-director for Technical Training. The rest of the session is to be given over to the following subjects:—(1) Report by the Committee on the improvement of patterns; and (2) Some more Steps along the Road to Rationalisation, by Oscar Querut patternmaker of La Louvière (Belgium).

At 12.30 the members adjourn for lunch.

The afternoon session (2.30 p.m.) opens with a Paper by Dr. J. W. Donaldson, presented on behalf of the Institute of British Foundrymen, on Thermal Treatment and Volume Changes in Iron between 15 and 600 deg. C. This is followed by "Eutectic Cast Iron," by Prof. Mitinsky, presented on behalf of the Czecho-Slovakian Association; whilst, finally, Signori Possenti and Scorza are to outline a new Italian process for centrifugal casting in green-sand moulds.

The third session opens at 9.30 on Saturday morning, when three Papers will be submitted. They are:—(1) Some Theories of Graphitisation, by Mr. H. A. Schwartz (American Exchange Paper); (2) Cleaning Steel Castings, with special reference to Sand, by Mr. Jacques Diemer; and (3) Core Binders for Non-ferrous Work, by Mr. André Miroux.

At the final session, 2.30 p.m., Mr. Le Thomas (foundry manager of the Piat Foundry at Soissons, is to deal with internal strains. The presentation of a report by the "Sand Committee" by its chairman, Mr. Magdelena, a talk by Mr. Ronceray, and a closing speech by the President, Mr. Leon Thomas, completes what we are certain is a well-balanced technical programme. A banquet is being held at the Hotel Lutetia at 7.30 in the evening, when opportunity will be taken of congratulating Mr. Thomas, Mr. Ropsy and Mr. Espana on being decorated by various Governments.

## Foundrymen Meet in Montreal.

A number of the leading foundrymen in the Montreal district met at luncheon at the Engineers' Club in Montreal on Wednesday, September 12, and were addressed by Dr. Richard Moldenke, the eminent foundry metallurgist, on some of the new and interesting developments of the foundry industry. The meeting was arranged jointly by Witherbee, Sherman & Company, Port Henry, N.Y., and their Canadian sales agents, A. C. Leslie & Company, Ltd., Montreal, Forrester B. Leslie of the latter company acting as chairman.

Following an interesting and instructive talk, the meeting was thrown open to discussion and questions, in which several took part, including Charles A. Pascoe, Canadian Car & Foundry Company, H. J. Roast, Robert Mitchell Company, and T. F. Kelly, Witherbee, Sherman & Company.

This meeting was held to further a better understanding between foundrymen and blast furnacemen, as to how the latter can best meet the various foundry requirements, and it was something new to the iron industry of the district. The main idea put forward was that while the furnaceman might be doing everything possible to operate efficiently his own plant, this was of little value to the foundryman unless the furnace made iron that would produce good castings. With quality as the main objective, the furnaceman wanted to know just where the foundryman had trouble, and what he therefore might require in the way of better or more suitable pig-iron.—"Iron Age."

The Right Hon. Arthur Henderson is to preside over the opening meeting of the Burnley Section of the Institute of British Foundrymen, when Mr. W. West, of Leyland Motors, is to present a paper on the "Practical Application of Science to Motor-Cylinder Making."

## American Foundrymen's Association.

### Publicity Campaign.

Functions of the recently organised educational committee of the American Foundrymen's Association are outlined in a report prepared by the former president, Mr. S. W. Utley, Detroit Steel Casting Company, Detroit, and approved by the board of directors. Members of the committee will be appointed soon.

As outlined in the report, "the object of this committee shall be to originate and disseminate to engineers and manufacturers information tending to produce a better realisation of the value of the foundry industry and the possible use of castings in all kinds of manufacturing processes." Its function is to be purely educational and it shall not have as its direct object the merchandising of any particular kind of casting or the creating of a specific market for any material. It will work with the various trade associations connected with the foundry industry. No direct advertising will be done, this to be left, as now, to the various individual companies, but it hoped to persuade manufacturers to include in their advertising copy information which will help to tell the story of the foundry industry.

Publicity matter will be worked up for publication by the technical Press and to some extent by the daily Press.

Another function of the educational committee will be to furnish speakers for technical societies and for conferences at schools and colleges. Exhibits of motion pictures of the foundry industry are suggested as a feature of this work.

Furthermore, the educational committee hopes to "impress upon the buying public that there is more to a casting than a certain number of pounds of metal; that the character of the foundry, its technical control, its engineering ability and the ability of its organisation is of as vital interest as the fact that it has a cupola or a furnace. The greatest drawback to the success of the foundry industry to-day is the poor quality of castings turned out by the unprogressive units, and the fact that the buyer considers the product of the well organised, progressive foundry on the same plane as the others. The bringing of this realisation to the purchasing public should make membership in the American Foundrymen's Association much more sought after."—"Iron Age" Report.

## Stanton Ironworks Welfare Scheme.

Every possible facility is afforded the youthful employees of the Stanton Ironworks to attend classes of instruction arranged for their own personal benefit, and at the prize distribution, held in the Company's canteen at the Ridding Works, there was a large gathering over which Mr. E. J. Fox (managing director of the firm) occupied the chair.

Mr. Fox expressed himself delighted with the results of the recent examinations, and said how pleased he was that such an excellent number of the firm's young employees availed themselves of the Company's welfare scheme. The Stanton Ironworks Company, he said, looked upon it as a duty to the nation to give their young employees every opportunity of attending classes of instruction, and he hoped they would all live to reap the benefit.

The supervisor's report showed that nearly 50 students had been successful in receiving prizes and expenses. These had been gained at several evening institutes, under the Stanton Ironworks Company's Welfare Scheme. It was pointed out that the students were following up their various courses year after year.

The Wales and Monmouth Branch of the Institute of British Foundrymen opened their session on Saturday last by a smoking concert at the Railway Hotel, Cardiff. The President of the Institute, Mr. S. H. Russell, together with the Branch President, welcomed a large gathering, and a splendid musical programme was provided by the Vivatones of Barry. At the conclusion of the gathering votes of thanks were passed, that to the President being carried with musical honours.

## Barriers to Prosperity.

Mr. W. Price Abell, the well-known Derby ironfounder, addressed the business men of Nottingham on Monday on the industrial conditions in America compared with those obtaining in England.

Mr. Abell, who is a past-President of the Derby Association of Engineers, said it was well to remember the insistence in the United States on the principle of self-reliance and the refusal to help non-producers, and the fact stood out that the American workman enjoyed a fuller life and a higher standard of living than any other in the world. In 1927 the United States sold to foreigners £143,000,000 more goods than they bought from the foreigner. On the other hand, Great Britain, despite her unemployment and short time in industry, bought from abroad £391,000,000 more than she sold. In this country we were handicapped by social charges, trade union restrictions, and our obsolete coinage system. In America, however, trade unions vied with the employer in suggesting improvements and greater benefits. The decimal system had reduced clerical charges and rendered commercial transactions much easier.

He mentioned that in Leeds, where domestic aid was difficult to get, 1,600 girls were drawing something like £900 a week, which sum, had it gone to relieving the rates on a large engineering firm, might have enabled that firm to secure contracts for locomotives that eventually went to Germany. The trend of affairs in this country, implied the speaker, had been to encourage slackness and burden manufacturers with liabilities which they ought not to be called upon to bear, and which placed them at a disadvantage in the markets of the world. In the United States the trade unions did not interfere with political matters, and the individual conception, so far as production and prosperity were concerned, induced men to approach their work with greater keenness in America, and there was not the same reliance upon the State for assistance that was met with here, and which had its repercussion upon output and industrial advancement.

A hearty vote of thanks was accorded Mr. Abell and the wish was expressed that he would again visit Nottingham on some other occasion.

## Catalogue Received.

**Foundry Supplies and Specialities.**—Messrs. Sulron, Limited, of Cloister Works, Congress Street, Sheffield, are adopting the system of issuing a monthly bulletin to bring to the notice of founders their products. Included in the list is a number of refractories (ganister, sea-sand and fireclay), agglomerants (core gum and liquid binders), and consumable stores (straw, rope, sprigs, brushes, etc.), but the main articles stressed are a core-sand mixer and a core-making (sausage) machine.

## Big Derby Contracts.

At a meeting of the Derby Town Council last Wednesday week it was recommended by the Electricity Committee that a 20,000-kilowatt turbo-alternator set be installed by Messrs. C. A. Parsons, at a cost of £54,650, and two boilers and an auxiliary plant from the International Combustion, Limited, at a cost of £46,068.

When following his employment in the foundry of the Combustion Engineering Company, Limited, Derby, Samuel Rogers, aged 19, of Sinfield Lane, Normanton, fell and sustained injuries to the thigh. He was removed to the Derbyshire Infirmary and detained.

A paper on "Pulverised Fuel and its Various Fields of Application" was read before the Society of Engineers, in London, on Monday, by Dr. G. E. K. Blythe, who stated that there was no longer room for scientific scepticism concerning the future of pulverised fuel. The principle was basically sound, and success was only a question of overcoming the practical difficulties. Pulverised-fuel developments had, in fact, reached the stage when they were likely to produce a change in marine-boiler firing that would be in the nature of a revolution.

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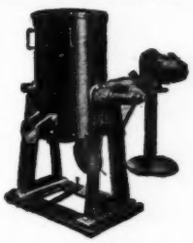

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## Trade Talk.

Messrs. Mylan & Smith (Engineers), Limited, colliery electrical engineers, should in future be addressed at their works, Bamford, *via* Sheffield.

Messrs. Major, Robinson & Company, Limited, have removed from "Scols" Works, Sykes Street, to 385 and 387, City Road, Cornbrook, Manchester.

The London & North-Eastern Railway Company have purchased from Messrs. Pease and Partners, Limited, the Lackenby slag heap, near Middlesbrough.

The imports of foreign iron ore at the Prince of Wales Dock at Workington, during September, amounted to 8,500 tons, against 7,980 tons for the previous month.

Messrs. John Hetherington & Sons, Limited, Manchester, have received a substantial order for textile machinery from the International Artificial Silk Company, Limited.

The Cabinet of New South Wales has approved the acceptance of the tender of Messrs. Babcock & Wilcox, Limited, for six boilers for the Ultimo power-house at a cost of £269,000.

The Admiralty have accepted the tender of Messrs. Sir John Jackson, Limited, London, for the construction of the new dockyard at Singapore. The contract time for completion is seven years.

Messrs. Hughes, Bolckow & Company, Limited, Middlesbrough, have secured the contract for dismantling the light cruiser "Weymouth," which will assure three-months' work at their shipbreaking establishment.

The title of the company recently registered to start a Government iron and steel works in South Africa is the South African Iron and Steel Industrial Corporation, Limited. The Johannesburg offices of the Corporation are at 82, Marshall Street.

Considerable damage was caused by a fire which occurred recently at the works in Spring Garden, Aberdeen, of Messrs. William McKinnon & Company, Limited, engineers and ironfounders. The foundry store and its equipment, it is reported, were destroyed.

The single-screw cargo steamer "Tilsington Court," built by Messrs. Sir W. G. Armstrong, Whitworth & Company, Limited, for the United British Steamship Company, Limited, was launched from the builders' Walker shipyard on September 28. She is designed to carry about 10,800 tons deadweight.

Messrs. W. T. Glover & Company, Limited, electrical wire and cable makers, Trafford Park, Manchester, announce changes in the addresses of their Cardiff, Liverpool and Birmingham offices, which are now as follows:—119, St. Mary Street, Cardiff; 17a, South Castle Street, Liverpool; 17, Summer Row, Birmingham. The firm's new Leeds warehouse is at 13, Park Square.

In a circular informing shareholders of Messrs. Richard Thomas & Company, Limited, that, while profits for the year ending September 30 will be larger than those for the previous year, they will be insufficient to justify the payment of the dividend on the preference shares now due, the directors state that the demand for tinplates remains at about 75 per cent. of manufacturing capacity in South Wales. The close agreement among tinplate manufacturers has been very beneficial to the industry, and this portion of the company's operations will, it is confidently believed, show increased profits in the coming year.

Messrs. Sir W. G. Armstrong, Whitworth & Company, Limited, have concluded an agreement with the Monometer Manufacturing Company (1918), Limited, whereby they become the sole manufacturers and distributors of the range of "Monometer" products, including pressure die-casting plants, gas- and oil-fired temperature-controlled furnaces for metal melting and heat-treatment processes, "Monard" non-poisonous case-hardening compounds, etc. The plant will be manufactured at the Scotswood Works of Messrs. Sir W. G. Armstrong, Whitworth & Company, Limited, where an extensive equipment is being installed for demonstration purposes.

Messrs. Edward Bennis & Company, Limited, of 28, Victoria Street, London, S.W.1, report the recent receipt of a number of contracts, among which may be mentioned mechanical coal and ash-handling plants for Sunderland Corporation electricity works, the Birtley Iron Company, Limited, Woodhall Duckham Vertical Retort & Oven Construction Company, Limited (for Croydon Gas Works, Surrey), and Hoylake U.D.C. electricity works; mechanical chain-grate stoker equipments for water-tube boilers for the City of London Electric Supply Company, Limited, Sunderland Corporation electricity works, Wakefield Corporation electricity works, and the L.M.S. Railway Company's Stonebridge Park power house, Wembley; and mechanical stoking equipment for Lancashire boilers for the Pressed Steel Company of Great Britain, Limited, and for textile, tobacco and other firms

Mr. T. G. Sorby, managing director of Messrs. Thomas Sorby & Sons, Limited, iron and steel merchants, was installed last week as Master Cutler of Sheffield. Referring to the position of the iron and steel industry, he said that a policy which might ultimately work for the common good might be the cause of temporary inconvenience or even permanent loss to some undertakings. That, however, must not be allowed to obscure the object in view—namely, the employment of the maximum number of men and the maximum amount of capital. The safeguarding of cutlery had undoubtedly been of value, yet, owing to the method of applying the duty, it had not been of so much value as it might have been either in restricting foreign imports or in the amount of duty collected. It would be an ill day for the engineering, shipbuilding, and allied trades if imports of iron and steel reached such important dimensions as to make their existence dependent on the goodwill of their foreign suppliers.

According to the "Ministry of Labour Gazette" for September, the following are among contracts placed by different Government departments:—Admiralty: T. Summerson & Sons, Limited, Darlington, railway material; Cammell Laird & Company, Limited, Birkenhead, cylindrical boilers; W. Beardmore & Company, Limited, Glasgow, steel castings; Craig & Donald, Ltd., Glasgow, plate-bending rolls; and James Bennie & Sons, Limited, Glasgow, plate-splitting shears. War Office: Vickers-Armstrongs, Limited, Sheffield, steel billets; and Steel, Peech & Tozer, Limited, shell steel. Post Office: British Mannesmann Tube Company, Limited, Landore, steel pipes; Russell Brothers (Walsall), Limited, wrought-iron tubes; and Cargo Fleet Iron Company, Limited, steel rails. Crown Agents for the Colonies: C. Richards & Sons, Limited, Darlaston, bolts and nuts; Wolverhampton Corrugated Iron Company, Limited, Ellesmere Port, corrugated sheets; Cleveland Bridge & Engineering Company, Limited, Darlington, corrugated steel plates; Weldless Steel Tube Company, Limited, Wednesfield, steel pipes; G. R. Turner, Limited, Notts, and Midland Railway Carriage & Wagon Company, Limited, Birmingham, wagons; and Stewarts & Lloyds, Limited, Glasgow, tubes.

## Personal.

Mr. A. T. Hall has been elected a director of the Hardy Patent Pick Company, Limited, Sheffield, in place of the late Mr. E. P. Bainbridge. Mr. Hall has been associated with the company for 40 years.

In a reference to the estate of the late Mr. Herbert Warner, in a recent issue, Mr. Warner was inaccurately described as head of Messrs. Warner & Company, Limited, Middlesbrough. Mr. Warner, in fact, retired and severed all connection with the firm in January, 1920.

The Parliamentary Secretary to the Department of Overseas Trade has recently appointed some additional members to his Advisory Committee, the membership of which now includes Sir William Larke, director of the National Federation of Iron and Steel Manufacturers; Mr. J. Gray Buchanan, senior partner in Messrs. William Jacks and Company; Mr. G. E. Rowland, chairman of Agricultural and General Engineers, Limited; Sir Gilbert C. Vyle, managing director of Messrs. W. and T. Avery, Limited, and vice-chairman of the Management Board of the Engineering and Allied Employers' National Federation; Mr. W. J. U. Woolcock, director of the Mond Staffordshire Refining Company, Limited; Mr. W. L. Hichens, chairman of Messrs. Cammell, Laird & Company, Limited, and of the English Electric Company, Limited; Sir Geo. Sutton, Bt., chairman and managing director of Messrs. W. T. Henleys Telegraph Works Company, Limited; Mr. C. Bruce Gardner, managing director of the Shelton Iron, Steel and Coal Company, Limited, chairman of Talk o' th' Hill Colliery, Limited, and director of Messrs. John Summers & Sons, Limited, and of the Wolverhampton Corrugated Iron Company, Limited; Captain H. E. P. D. Acland, of Messrs. Vickers, Limited; Lt.-Col. E. Kitson Clark, chairman of Messrs. Kitson & Company, Limited, and Sir Edgar R. Jones, of the Welsh Plate and Sheet Manufacturers' Association.

### Wills.

| | |
|---|---|
| Green, H., director of Messrs. Willford & Company, Limited, Sheffield ... ... | £200,186 |
| Vernon, P. V., a director of Messrs. Alfred Herbert, Limited, Coventry ... | £32,045 |
| Kipling, J. A., of Penarth, representative of Messrs. Hadfields, Limited, Sheffield | £7,689 |
| Laird, R. M., of Windermere, associated with Messrs. Cammell, Laird & Company, Limited ... ... ... ... | £10,692 |

## Contracts Open.

**Angora,** October 25.—Points, crossings, rails and fishplates, for the Direction Generale des Fabriques Militaires. The Department of Overseas Trade. (Reference A.X. 6874.)

**Cairo,** November 1.—Steel and iron works for lock and barrage gates, for the Egyptian Ministry of Public Works, Irrigation Department. The Department of Overseas Trade. (Reference A.X. 6819.)

**Alexandria,** October 23.—Two tandem-type heavy-oil internal-combustion road rollers, for the Municipality. The Department of Overseas Trade. (Reference A.X. 6829.)

**London, S.W.,** November 12.—Four electrically-driven centrifugal sewage pumping sets, for the London County Council. The Chief Engineer, Old County Hall, Spring Gardens, London, S.W.1. (Fee £5, returnable.)

**Waterford,** October 19.—Supply and erection of an optional hand- and electrically-operated hoisting and sluing 20-ton travelling crane, for the Harbour Commissioners. The Harbour Engineer, Harbour Engineer's Office, Waterford. (Fee £1 1s., returnable.)

## Reports and Dividends.

**Richard Thomas & Company, Limited.**—The preference dividend which was due on October 1 has been passed.

**Bell's United Asbestos Company, Limited.**—Interim dividend on the ordinary shares of 1s. per share, being 5 per cent., actual, less tax.

**Steel Company of Scotland, Limited.**—To reserve, £12,500; depreciation, £3,000; brought forward, £110,494; carried forward, £118,336.

**Murex, Limited.**—Profit, £14,786; brought in, £6,194; received under arbitration award, £3,304; depreciation, £2,124; dividend of 10 per cent.; carried forward, £14,854.

**Birmingham Small Arms Company, Limited.**—Dividends for the six months ended July at the rate of 5 per cent. on the "A" preference shares and 6 per cent. on the "B" preference shares, both less tax.

**Vulcan Foundry, Limited.**—Gross profit, £118,184; brought forward, £100,818; net profit, after meeting all charges, £70,634; surplus from reserve for depreciation, £3,000; dividend of 8 per cent. on the ordinary shares; carried forward, £101,716.

**Tata Iron & Steel Company, Limited.**—Net profits, Rs. 1,09,80,541; brought forward, Rs. 4,55,701; depreciation, Rs. 50,00,000; appropriated for debenture sinking fund, Rs. 6,15,000; dividends on first preference shares at rate of 6 per cent. per annum, and on second preference at rate of 7½ per cent.; carried forward, Rs. 1,68,928.

## Iron and Steel Production.

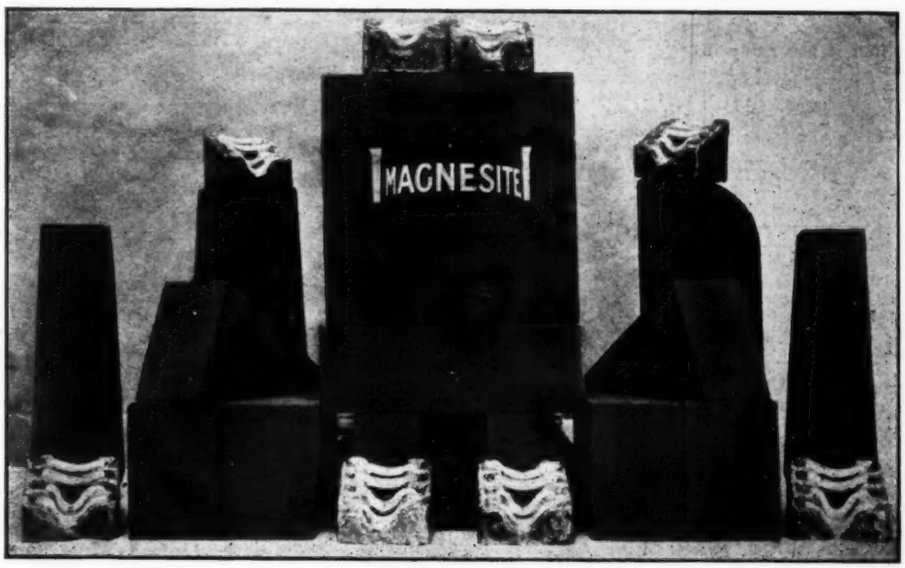
The National Federation of Iron and Steel Manufacturers in their Statistical Bulletin for August state that the production of pig-iron further declined in August and amounted to 519,000 tons only, compared with 531,800 tons in July and 596,100 tons in August last year. The number of furnaces in blast at the end of the month was 130, a net decrease of one compared with the previous month. Steel production last August amounted to 648,300 tons, compared with 666,900 tons in July and 643,100 tons in August, 1927.

Returns received from 132 firms employing 80,827 workpeople at the end of last August showed an increase of 2,705 compared with July, but a decrease of 6,099 compared with August, 1927. According to returns received from 135 firms employing 108,248 workpeople, the average earnings per head in June amounted to £3s., compared with £3 in June and £3 0s. 2d. in May.

Speaking at the National Conference of the Institute of Cost and Works Accountants at Birmingham, Mr. J. A. Lacey said that one was at a serious loss to reconcile reduction in costs of production and a continuity of national expenditure at the rate of £850,000,000 per annum. It showed that the task of reducing costs was the responsibility not of one element of the community, but a service required of all sections identified in national life. If each and all were, in their several spheres, bent in the direction of economy, the result mirrored in minimising costs of production would be almost beyond conjecture.

**Established 1913.**

**BRITISH MADE MAGNESITE BRICKS, PERFECT IN SHAPE, HIGHLY REFRACTORY, EQUAL IN PRICE**




**"SERVICE** GRC **FIRST"**

*—yes, but in this case, usefulness and craftsmanship go hand in hand.*

**The perfection of shape and regularity of size of our**

**BRITISH MADE**

# MAGNESITE BRICKS

**are due in large measure to**

**accurate burning.**

*The temperature is controlled by Holdcroft's Thermoscope Bars, sets of which are placed in each kiln. The even bending of the bars shown above, and which are taken from several kilns, illustrates the regularity of firing.*

## THE GENERAL REFRACTORIES CO., LTD.,

**WICKER ARCHES,**

**SHEFFIELD.**

**'Phone: 22311.**

**Telegrams: Refractory, Sheffield.**

# Iron and Steel Markets.

## Pig-Iron.

**MIDDLESBROUGH.**—Though some slight improvement in demand for Cleveland iron is admittedly in progress, the general conditions of the market still leave much to be desired before anything like a return to normal activity can be accomplished, or even approached with any certainty of success. It is scarcely necessary to reiterate the many obstacles to a fairly healthy revival of the iron trade which at present exist, but perhaps the most important factor to be faced is the continued high prices enforced by Cleveland makers, an almost insuperable impediment to expansion in either the home or export markets. One effect, however, of this firmness on the part of Tees-side makers has been to convince consumers that nothing is to be gained by delaying purchases, and during the current week orders have been placed much more freely than has been reported for some time past. Exports continue on the slow side, very little Cleveland iron now crossing the North Sea, and at present prices there is not much likelihood of an improvement. Nevertheless, makers' fixed minimum quotations are unchanged, as follow:—No. 1 Cleveland foundry iron, 68s. 6d. per ton; No. 3 G.M.B., 66s.; No. 4 foundry, 65s.; No. 4 forge, 64s. 6d. per ton.

As previously reported, conditions in the East Coast hematite market are steadily improving, and with stocks gradually diminishing, prices are very firmly maintained, the current quotation for mixed numbers now ruling at 70s. per ton and upwards, with No. 1 quality marked at 70s. 6d. to 71s. per ton. On the North-West Coast Bessemer mixed numbers are also firmer at 68s. per ton at works.

**LANCASHIRE.**—The prospects of autumn trade in foundry pig-iron in this area, though a shade more promising, are not altogether satisfactory, and at the moment business is again on a restricted scale. Prices, however, continue firmly held, Derbyshire makers of No. 3 quality quoting 67s. 6d. and Staffordshire 67s. per ton delivered Manchester or equal distance. Cleveland is on offer at about 79s. per ton, and Scottish at from 87s. 6d. to 90s., according to brand.

**THE MIDLANDS.**—During the current week the local markets for pig-iron have developed a firmer tendency, and makers are now asking higher prices than they were a week or so ago. There is very little Derbyshire iron to be had under 60s. per ton f.o.t., and Northants. is now at 56s. and upwards f.o.t., with North Staffordshire at 60s. to 60s. 6d. f.o.t. From the point of view of consumers of foundry iron, there is very little change. Many of the ironfounders are still short of work, and very few are as busy as they should be at this time of the year.

**SCOTLAND.**—Little change for the better can be reported in the Scotch pig-iron market, though there is certainly a slightly more optimistic feeling prevailing than has been the case for some weeks, but this feeling does not seem to crystallise itself into better business. There is no confidence shown yet by buyers, who continue to purchase from hand to mouth. Prices are unchanged, and makers are very reluctant to grant concessions, as they cannot afford to do so.

## Finished Iron.

The quarterly meeting of the trade at Birmingham this week, though but a shadow of its ancient importance, brought a tolerably numerous attendance on 'Change, and a fair amount of business was transacted. With reference to the section for finished material, there was a little more activity in the demand for the better qualities of iron, and the outlook is now a little more reassuring. There is, however, no alteration in the position affecting crown and the cheaper qualities. There is much competition for this class of business, and there is nothing like sufficient tonnage available to keep the works occupied. Qdotations continue to vary to a considerable degree as a result of this position, and crown iron is on offer at between £9 and £9 15s. The lower level is quoted by works outside the district. The mills are not receiving much support for nut and bolt iron at prices between £8 12s. 6d. and £9, as there is still a wide margin between these levels and the prices quoted by the Continental works for their No. 3 grade.

## Steel.

At Sheffield the market for steel continues quiet, although a fair amount of business is passing. Basic billets are a much better market than acid. The output of high-quality steels is increasing, and the majority of the basic steel plants are very well employed, thanks mainly to the higher prices now ruling for imported materials. The railways are giving out very meagre orders for steel. In the semi-finished steel department the difficulty of obtaining supplies of Continental products and the prices which are being demanded have led to price increases in British material, and some good orders have been placed with the home works. There has been a steady demand in the finished steel department, although overseas buyers appear to have covered their near requirements for the time being, and to be inclined to await developments. In the tinplate market quotations rule a shade firmer at 18s. to 18s. 3d. basis, net cash, f.o.b. Wales.

## Scrap.

Business in the various markets for scrap metals for foundry use continues generally quiet, with very few changes in price for the qualities mostly in demand. In the Cleveland district small parcels of ordinary heavy cast iron can be disposed of at round about 60s. per ton, and up to 65s. has been paid for machinery quality in handy sizes. At Birmingham there is a fair demand for cast-iron scrap for use in the local foundries, and prices are firm. At present 65s. delivered is offered for heavy cast-iron machinery scrap in cupola sizes, and 52s. 6d. to 55s. delivered for light cast-iron scrap. In Scotland the cast-iron market is still weak, and sellers have difficulty in finding outlets for material of any class, particularly machinery, which is nominally at 65s. to 66s., with very few buyers. Heavy ordinary cast-iron scrap, suitable for foundries, is 61s. 3d. to 62s. 6d., and steelworks cast-iron scrap 60s. to 61s. 3d. There is no change in light cast-iron scrap at 57s. 6d. to 58s. 6d., and in cast-iron firebars at 54s. to 55s. The above prices are all per ton, delivered f.o.t. consumers' works.

## Metals.

**Copper.**—Reports of increased world consumption of copper have had the immediate effect in markets of further strengthening values, which, however, still show a wide margin between standard and refined, but, with larger deliveries from home warehouses, this disparity may be shortly reduced. Copper is, of course, no exception to the laws of supply and demand, and it is upon these factors that production and high or low prices depend; consequently producers have speeded up supplies in order to meet the situation, but, as there has not yet been enough time for the increased output to make itself felt, it does not seem likely that there will be any very material alteration in values in the near future.

Closing quotations are:—

*Cash.*—Thursday, £64 11s. 3d. to £64 12s. 6d.: Friday, £64 16s. 3d. to £64 17s. 6d.; Monday, £64 12s. 6d. to £64 15s.; Tuesday, £64 13s. 9d. to £64 15s.; Wednesday, £64 13s. 9d. to £64 16s. 3d.

*Three Months.*—Thursday, £65 to £65 1s. 3d.; Friday, £65 3s. 9d. to £65 5s.; Monday, £65 to £65 1s. 3d.; Tuesday, £65 2s. 6d. to £65 3s. 9d.; Wednesday, £65 2s. 6d. to £65 3s. 9d.

**Tin.**—Movements in standard cash tin of late have reflected an active speculative influence in markets, resulting in fluctuating values, so far inclined to somewhat lower levels, but fairly steady on the whole. The statistical position is still rather indefinite, but consumption has expanded, and a very large increase in production does not seem to have brought about a corresponding increase in the available supplies. The following are the official figures of the total visible supply:—Month's shipments, 10,256 tons; other afloat, 2,871 tons; total afloat, 13,127 tons; landing, 2,290 tons; in warehouse, 4,507 tons; total stocks, 6,797 tons. Total visible supply, 19,924 tons.

Official closing prices:—

*Cash.*—Thursday, £222 10s. to £222 15s.; Friday, £218 12s. 6d. to £218 17s. 6d.; Monday, £218 15s. to £219; Tuesday, £218 15s. to £219; Wednesday, £220 15s. to £221.

*Three Months.*—Thursday, £220 7s. 6d. to £220 10s.; Friday, £217 7s. 6d. to £217 10s.; Monday, £216 15s. to £217; Tuesday, £216 10s. to £216 15s.; Wednesday, £217 15s. to £217 17s. 6d.

**Spelter.**—There has been an improvement in demand from consumers, but the market has been quite unresponsive, and prices have remained quiet and steady. Every indication points to the fact that consumption continues to keep pace with production, although the latter shows almost an unprecedented increase in volume.

Daily quotations are:—

*Ordinary.*—Thursday, £24; Friday, £24; Monday, £23 17s. 6d.; Tuesday, £24; Wednesday, £24 2s. 6d.

**Lead.**—The trend of this market has been downwards; consumers seem to have covered their requirements, and there has been only light buying. American advices state that the situation there holds good, a steady demand is comfortably met, and, although business is not on a large scale, producers are not at all anxious.

Closing prices:—

*Soft Foreign Prompt.*—Thursday, £22 1s. 3d.; Friday, £22 2s. 6d.; Monday, £22 3s. 9d.; Tuesday, £22 5s.; Wednesday, £22 1s. 3d.

## Gifts from Ironfounders.

**How the Newark Students are being Helped.**

For the session just commencing Newark has made many additions and improvements for the benefit of instructing the students in engineering, the block containing laboratories for heat engines and materials with temporary accommodation for science. The Engineering Department has the advantage of the following advisory committee: Messrs. J. T. Graham (chairman), who is general manager of Messrs. Worthington-Simpson, Ltd., ironfoundrs, of Balderton, R. Abbott, G. E. Ashbury, R. H. Bradley, C. W. Lane, C. Nicholson, J. E. Palmer, H. Pullman, J. D. Scaife, A. J. Waring, A.M.I.E.E. (senior lecturer), and W. Dickinson. The engineering department now possesses a suite of laboratories which are being completely equipped for engineering students largely by generous donations received from local engineering firms. The laboratories with their most important equipment are:—

*Boiler House.*—Horizontal semi-multitubular, fitted for experimental work, presented by Messrs. Abbott & Company, Limited.

*Heat Engine Laboratory.*—Twenty horse-power horizontal steam engine, presented by Messrs. W. N. Nicholson & Sons, Ltd., experimental condenser for same, presented by Messrs. Worthington-Simpson, Limited, 7 h.p. Crossley gas engine and dynamo, presented by Boots, Limited; 10 h.p. two-stroke crude oil engine, completely equipped, presented by Messrs. Clayton, Shuttleworth & Babcock, Limited; 3-cylinder Gardiner paraffin launch engine, presented by the Trent Navigation Company, Limited.

*Small Machine Shop.*—The equipment of this shop was assisted by gifts from Farrars Boiler Works, Limited, and shafting was presented and fitted by Messrs. Ransome & Marles Ball Bearing Company, Limited.

*Electrical Engineering Laboratory.*—Four k.w. motor generator set with controls presented by the British Thomson-Houston Company, Limited; 1 k.w. S.P. transformer, voltmeter, ammeters, 1 house-meter, 1 watt-meter, presented by Ferranti, Limited.

*The Strength of Material Laboratory* will include complete equipment for metallurgy, testing on all materials in tension, compression, bending and torsion. The materials range from cement, bricks, stone, etc., to timber and all metals. There will be installed a modern multiple-lever, 50-ton universal testing machine, by Messrs. J. Buckton & Company, Limited. The laboratories will include a gas muffle furnace, presented by Messrs. August's, Limited, of Halifax.

Prices for pig-iron No. 3, which were left unchanged for September by the West European Pig-Iron Union, will probably be increased for October, there being no longer any need to keep them low, as the Dutch competing firms have also increased their prices.

The American Manganese Steel Company, of 333, North Michigan Avenue, Chicago, have published a brochure entitled "Manganese Steel," which describes the history and properties of this material. The research laboratories of the concern are also detailed.

THE KEY TO BETTER CASTINGS

# Capponfield

## Warm "W.B." Blast

THE century-old renown of South Staffordshire has been built up on its Blast Furnace practice.

Bradley's Capponfield "W.B." is a quality Pig Iron made under carefully controlled conditions to meet modern foundry requirements in the production of quality castings.

Slow-working with cool air on small output produces Pig Iron with low total carbon content and close in the grain. Its inherent properties promote that soundness and strength so essential in grain rolls, barrels and cylinders of all kinds.

3 Perfect Grades

**Capponfield H.B.**
(HOT BLAST)

**Capponfield W.B.**
(WARM BLAST)

**Capponfield C.B.**
(COLD BLAST)

Bradley's CAPPONFIELD PIG IRON

"Capponfield Quality"

All Capponfield Irons are direct blast-furnace products. Bradley's well-known Refined Irons are made at the Darlaston Works.

**BRADLEY & FOSTER LIMITED**

CAPPONFIELD AND DARLASTON, STAFFS

(All communications should be addressed to Darlaston.)

TELEPHONE: DARLASTON 16 (Private Branch Exchange). TELEGRAMS: BRADLEY'S, DARLASTON

# WEEKLY PRICE CURRENT.

## COPPER.

| | £ s. d. |
|---|---|
| Standard cash | 64 13 9 |
| Three months | 65 2 6 |
| Electrolytic | 71 5 0 |
| Tough | 68 0 0 |
| Best selected | 68 0 0 |
| Sheets | 96 0 0 |
| India | 78 0 0 |
| Wire bars | 71 15 0 |
| Do. October | 71 15 0 |
| Do. November | 71 15 0 |
| Ingot bars | 71 12 6 |
| H.C. Wire rods | 75 15 0 |
| Off. av. cash, September | 63 11 3 |
| Do. 3 mths., September | 64 1 8½ |
| Do., Sttlmnt., September | 63 11 3 |
| Do., Electro, September | 70 1 0 |
| Do., B.S., September | 66 19 4½ |
| Aver. spot price, copper, Sep. | 63 11 3 |
| Do., Wire bars, September | 70 6 0 |
| Solid drawn tubes | 13½d. |
| Brazed tubes | 13½d. |
| Wire | 10d. |

## BRASS.

| | |
|---|---|
| Solid drawn tubes | 12d. |
| Brazed tubes | 14d. |
| Rods, drawn | 11½d. |
| Rods, extd. or rlld. | 7½d. |
| Sheets to 10 w.g. | 10½d. |
| Wire | 10½d. |
| Rolled metal | 9½d. |
| Yellow metal rods | 7½d. |
| Do. 4 × 4 Squares | 8d. |
| Do. 4 × 3 Sheets | 8½d. |

## TIN.

| | £ s. d. |
|---|---|
| Standard cash | 220 15 0 |
| Three months | 217 15 0 |
| English | 219 5 0 |
| Bars | 224 0 0 |
| Straits | 221 5 0 |
| Australian | 221 15 0 |
| Eastern | 222 15 0 |
| Banca | 226 15 0 |
| Off. av. cash, September | 215 15 7½ |
| Do., 3 mths., September | 212 17 3 |
| Do., Sttlmt., September | 215 15 3 |
| Aver. spot, September | 215 15 7½ |

## SPELTER.

| | |
|---|---|
| Ordinary | 24 2 6 |
| Remelted | 22 15 0 |
| Hard | 19 10 0 |
| Electro 99.9 | 27 10 0 |
| English | 24 7 6 |
| India | 20 10 0 |
| Zinc dust (Nom.) | 35 5 0 |
| Zinc ashes | 7 15 0 |
| Off. aver., September | 24 11 2½ |
| Aver., spot, September | 24 9 11½ |

## LEAD.

| | |
|---|---|
| Soft foreign ppt. | 22 1 3 |
| English | 23 10 0 |
| Off. average, September | 21 18 2½ |
| Average spot, September | 22 1 0 |

## ZINC SHEETS, &c.

| | |
|---|---|
| Zinc sheets, English | 33 0 0 |
| Do. V.M. ex whf. | 31 5 0 |
| Rods | 39 0 0 |
| Boiler plates | 29 0 0 |
| Battery plates | 30 10 0 |

## ANTIMONY.

| | |
|---|---|
| Special brands, Eng. | 59 0 0 |
| Chinese | 40 5 0 |
| Crude | 33 10 0 |

## QUICKSILVER.

| | |
|---|---|
| Quicksilver | 23 15 0 |

## FERRO-ALLOYS AND STEEL-MAKING METALS.

| | |
|---|---|
| Ferro-silicon— | |
| 25% | 7 17 6 |
| 45/50% | 12 0 0 |
| 75% | 19 0 0 |
| Ferro-vanadium— | |
| 35/50% | 14/- lb. Va. |
| Ferro-molybdenum— | |
| 70/75% c. free | 4/3 lb. Mo. |
| Ferro-titanium— | |
| 23/25% carbonless | 1/1 lb. |
| Ferro-phosphorus, 20/25% | £18 0 0 |
| Ferro-tungsten— | |
| 80/85%, c. fr. | 1/3 lb. |
| Tungsten metal powder— | |
| 98/99% | 1/8 lb. |
| Ferro-chrome— | |
| 2/4% car. | £30 0 0 |
| 4/6% car. | £21 5 0 |
| 6/8% car. | £20 10 0 |
| 8/10% car. | £20 10 0 |
| Ferro-chrome— | |
| Max. 2% car. | £32 15 0 |
| Max. 1% car. | £37 0 0 |
| Max. 0.70% car. | £42 0 0 |
| 70% carbonless | 1/- lb. |
| Nickel—99% cubes or pellets | £175 0 0 |
| Ferro-cobalt | 9/- lb. |
| Aluminium 98/99% | £98 0 0 |
| Metallic chromium— | |
| 96/98% | 2/7 lb. |
| Ferro-manganese (net)— | |
| 76/80% loose | £13 15 0 |
| 76/80% packed | £14 15 0 |
| 76/80% export | £14 10 0 |
| Metallic manganese— | |
| 94/96% carbonless | 1/6 lb. |

Per ton unless otherwise stated.

## HIGH-SPEED TOOL STEEL.

| | |
|---|---|
| Finished bars, 14% tungsten | £0 2 3 |
| Finished bars, 18% tungsten | £0 2 9 |

Per lb. net, d/d buyers' works.

| | |
|---|---|
| Extras— | |
| Rounds and squares, 3 in. and over | 4d. lb. |
| Rounds and squares, under ½ in. to ¼ in. | 3d. lb. |
| Do., under ¼ in. to ⅛ in. | 1/- lb. |
| Flats, ½ in. × ¼ in. to under 1 in. × ½ in. | 3d. lb. |
| Do., under ¼ in. × ¼ in. | 1/-lb. |
| Bevels of approved sizes and sections | 6d. lb. |

Bars cut to length, 10% extra.

| | |
|---|---|
| Scrap from high-speed tool steel— | |
| Scrap pieces | 3d. |
| Turnings and swarf | 1d. |

Per lb. net, d/d steel makers' works.

## SCRAP.

| | £ s. d. | £ s. d. |
|---|---|---|
| South Wales— | | |
| Hvy. steel | 3 7 0 | to 3 8 0 |
| Bundled steel and shrngs. | 3 1 0 | to 3 2 6 |
| Mixed iron and steel | 3 0 0 | to 3 2 6 |
| Heavy cast iron | 2 17 0 | to 2 18 0 |
| Good machinery for foundries | 3 2 6 | |
| Cleveland— | | |
| Heavy steel | 2 15 0 | |
| Steel turnings | 2 8 0 | |
| Cast iron borings | 2 1 6 | |
| Heavy forge | 3 10 0 | |
| Bushelled scrap | 3 0 0 | |
| Cast-iron scrap | 3 2 6 | |
| Lancashire— | | |
| Cast-iron scrap | 2 12 6 | to 3 5 0 |
| Hvy. wrought | 3 2 6 | to 3 5 0 |
| Steel turnings | 2 5 0 | to 2 6 0 |

London—Merchants' buying prices delivered yard.

| | |
|---|---|
| Copper (clean) | 52 0 0 |
| Brass | 38 0 0 |
| Lead (less usual draft) | 18 10 0 |
| Tea lead | 15 10 0 |
| Zinc | 16 0 0 |
| New aluminium cuttings | 64 0 0 |
| Braziery copper | 49 0 0 |
| Gunmetal | 49 0 0 |
| Hollow pewter | 150 0 0 |
| Shaped black pewter | 105 0 0 |

## PIG-IRON.

*(f.o.t. unless otherwise stated.)*

| | |
|---|---|
| N.E. Coast— | |
| Foundry No. 1 | 68/6 |
| Foundry No. 3 | 66/- |
| Foundry No. 4 | 65/- |
| Forge No. 4 | 64/6 |
| Hematite No. 1 | 70/9 |
| Hematite M/Nos. | 70/- |
| N.W. Coast— | |
| Hem. M/Nos. d/d Glas. | 78/6 |
| ,, d/d Birm. | 86/- |
| Midlands— | |
| Staffs. common* | 67/6 |
| ,, No. 4 forge | 56/- |
| ,, No. 3 fdry. | 60/- |
| Shrops. basic | — |
| ,, Cold blast, ord.* | — |
| ,, ,, roll iron* | — |
| * d/d Birmingham. | |
| Northants forge | 53/6 |
| ,, fdry. No. 3 | 56/- |
| Derbyshire forge | 59/- |
| ,, fdry. No. 3 | 60/- |
| ,, basic | 65/- |
| Scotland— | |
| Foundry No. 1 | 75/- |
| ,, No. 3 | 70/- |
| Hem. M/Nos. | 74/- |
| Sheffield (d/d district)— | |
| Derby forge | 61/- |
| ,, fdry. No. 3 | 64/- |
| Lincs. forge | 62/6 |
| ,, fdry. No. 3 | 65/- |
| E.C. hematite | 81/- |
| W.C. hematite | 84/- |
| Lincs. (at furnaces)— | |
| Forge No. 4 | 58/- |
| Foundry No. 3 | 60/6 |
| Basic | 60/- |
| Lancashire (d/d-eq. Man.)— | |
| Derby forge | — |
| ,, fdry. No. 3 | 67/6 |
| Northants foundry No. 3 | — |
| Dalzell, No. 3(special) | 100/- to 102/6 |
| Summerlee, No. 3 | 87/6 to 90/- |
| Glengarnock, No. 3 | 87/6 to 90/- |
| Gartsherrie, No. 3 | 87/6 to 90/- |
| Monkland, No. 3 | 87/6 to 90/- |
| Shotts, No. 3 | 87/6 to 90/- |

## FINISHED IRON AND STEEL.

*Usual District deliveries for iron; delivered consumers' station for steel.*

| Iron— | £ s. d. | £ s. d. |
|---|---|---|
| Bars (cr.) nom. | | 10 5 0 |
| Nut and bolt iron | 8 12 6 | to 8 17 6 |
| Hoops | | 11 10 0 |
| Marked bars (Staffs.) f.o.t. | | 12 0 0 |
| Gas strip | | 11 10 0 |
| Bolts and nuts, ¾ in. × 4 in. | | 15 5 0 |
| Steel— | | |
| Ship plates | 8 7 6 | to 8 12 6 |
| Boiler plts. | | 10 10 0 |
| Chequer plts. | | 10 12 6 |
| Angles | | 7 17 6 |
| Tees | | 8 17 6 |
| Joists | | 7 17 6 |
| Rounds and squares, 3 in. to 5½ in. | | 8 17 6 |
| Rounds under 3 in. to ¾ in. (Untested) | | 7 15 0 and upwards |
| Flats, over 5 in. wide and up | | 8 7 6 |
| Flats, 5 in. to 1½ in. | | 7 17 6 |
| Rails, heavy | | 8 10 0 |
| Fishplates | | 12 10 0 |
| Hoops (Staffs.) | | 10 0 0 |
| Black sheets, 24g. | 10 0 0 | to 10 10 0 |
| Galv.cor.shts.,24g. | 13 10 0 | to 13 15 0 |
| Galv. fencing wire 8g. plain | | 12 10 0 |
| Billets, soft | 6 2 6 | to 6 10 0 |
| Billets, hard | 7 2 6 | to 7 12 6 |
| Sheet bars | | 6 0 0 |
| Tin bars | | 6 0 0 |

## PHOSPHOR BRONZE.

| | Per lb. basis. |
|---|---|
| Strip | 1 2½ |
| Sheet to 10 w.g. | 1 3 |
| Wire | 1 3½ |
| Rods | 1 3 |
| Tubes | 1 7½ |
| Castings | 1 2 |

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

## NICKEL SILVER, &c.

| | per lb. |
|---|---|
| Ingots for raising | 9d. to 1/3 |
| Rolled— | |
| To 9 in. wide | 1/3 to 1/9 |
| To 12 in. wide | 1/3½ to 1/9½ |
| To 15 in. wide | 1/3½ to 1/9½ |
| To 18 in. wide | 1/4 to 1/10 |
| To 21 in. wide | 1/4½ to 1/10½ |
| To 25 in. wide | 1/5 to 1/11 |
| Ingots for spoons and forks | 9d. to 1/5½ |
| Ingots rolled to spoon size | 1/- to 1/8½ |
| Wire round— | |
| 3/0 to 10 G. | 1/6½ to 2/1½ |

with extras according to gauge.

## AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

| | Dols. |
|---|---|
| No. 2X foundry, Phila. | 20.76 |
| No. 2 foundry, Valley | 17.00 |
| No. 2 foundry, Birm. | 16.25 |
| Basic | 18.02 |
| Bessemer | 19.01 |
| Malleable | 19.01 |
| Grey forge | 18.26 |
| Ferro-mang. 80% d/d | 105.00 |
| O.-h. rails, h'y at mill | 43.00 |
| Bess billets | 32.00 |
| O.-h. billets | 32.00 |
| O.-h. sheet bars | 32.00 |
| Wire rods | 42.00 |
| | Cents. |
| Iron bars, Phila. | 2.12 |
| Steel bars | 1.90 |
| Tank plates | 1.90 |
| Beams, etc. | 1.90 |
| Skelp, grooved steel | 1.90 |
| Skelp, sheared steel | 1.90 |
| Steel hoops | 2.20 |
| Sheets, black, No. 24 | 2.65 |
| Sheets, galv., No. 24 | 3.40 |
| Sheets, blue an'l'd., 9 and 10 | 2.00 |
| Wire nails | 2.55 |
| Plain wire | 2.40 |
| Barbed wire, galv. | 3.20 |
| Tinplates, 100 lb. box | $5.25 |

## COKE (at ovens).

| | |
|---|---|
| Welsh foundry | 27/- to 35/- |
| ,, furnace | 19/- to 21/- |
| Durham and North. | |
| ,, foundry | 13/6 to 14/6 |
| ,, furnace | 14/- |
| Midlands, foundry | — |
| ,, ,, furnace | 13/6 to 14/6 |

## TINPLATES.

f.o.b. Bristol Channel ports.

| | |
|---|---|
| I.C. Cokes | 20×14 box 18/- to 18/3 |
| ,, | 28×20 ,, 36/3 |
| ,, | 20×10 ,, 26/6 |
| ,, | 18½×14 ,, 19/- |
| C.W. | 20×14 ,, 15/- |
| ,, | 28×20 ,, 33/6 |
| ,, | 20×10 ,, 22/- |
| ,, | 18½×14 ,, 15/9 |
| Terneplates | 28×20 33/6 per box basis f.o.b. |

## SWEDISH IRON.

| | |
|---|---|
| Bars, hammered, | £17 10 0 to £18 10 0 |
| Rolled Ord. | £15 0 0 to £15 10 0 |
| Nail rods | £15 7 6 to £15 15 0 |
| Keg. steel nom. | £32 to £33 |
| Faggot steel nom. | £22 to £25 |
| Blooms, according to quality | £8 to £12 |
| Pig-iron | £5 15 0 to £6 0 0 |

all f.o.b. Gothenburg

### TUBES AND FITTINGS.

Up to and incl. 6 in.

| | Tubes. | Fittings. |
|---|---|---|
| Gas .. .. | 67½% .. | .. 50% |
| Water .. .. | 63½% .. | .. 45% |
| Steam .. .. | 60% .. | .. 40% |

W.I. 10% extra.

### DAILY FLUCTUATIONS.

**Standard Copper (cash).**

| | | £ s. d. | |
|---|---|---|---|
| Oct. 4 .. | 64 11 3 | inc. | 1/3 |
| ,, 5 .. | 64 16 3 | ,, | 5/- |
| ,, 8 .. | 64 12 6 | dec. | 3/9 |
| ,, 9 .. | 64 13 9 | inc. | 1/3 |
| ,, 10 .. | 64 13 9 | No change | |

**Electrolytic Copper.**

| | £ s. d. | |
|---|---|---|
| Oct. 4 .. | 71 5 0 | No change |
| ,, 5 .. | 71 5 0 | ,, ,, |
| ,, 8 .. | 71 5 0 | ,, ,, |
| ,, 9 .. | 71 5 0 | ,, ,, |
| ,, 10 .. | 71 5 0 | ,, ,, |

**Standard Tin (cash).**

| | £ s. d. | | |
|---|---|---|---|
| Oct. 4 .. | 222 10 0 | inc. | 2/6 |
| ,, 5 .. | 218 12 6 | dec. | 75/- |
| ,, 8 .. | 218 15 0 | inc. | 2/6 |
| ,, 9 .. | 218 15 0 | No change | |
| ,, 10 .. | 220 15 0 | inc. | 40/- |

**Tin (English ingots).**

| | £ s. d. | | |
|---|---|---|---|
| Oct. 4 .. | 221 10 0 | inc. | 10/- |
| ,, 5 .. | 217 10 0 | dec. | 80/- |
| ,, 8 .. | 217 10 0 | No change | |
| ,, 9 .. | 217 5 0 | dec. | 5/- |
| ,, 10 .. | 219 5 0 | inc. | 40/- |

**Zinc Sheets (English).**

| | £ s. d. | |
|---|---|---|
| Oct. 4 .. | 33 0 0 | No change |
| ,, 5 .. | 33 0 0 | ,, ,, |
| ,, 8 .. | 33 0 0 | ,, ,, |
| ,, 9 .. | 33 0 0 | ,, ,, |
| ,, 10 .. | 33 0 0 | ,, ,, |

**Spelter (ordinary).**

| | £ s. d. | | |
|---|---|---|---|
| Oct. 4 .. | 24 0 0 | dec. | 2/6 |
| ,, 5 .. | 24 0 0 | No change | |
| ,, 8 .. | 23 17 6 | dec. | 2/6 |
| ,, 9 .. | 24 0 0 | inc. | 2/6 |
| ,, 10 .. | 24 2 6 | ,, | 2/6 |

**Lead (English).**

| | £ s. d. | |
|---|---|---|
| Oct. 4 .. | 23 10 0 | No change |
| ,, 5 .. | 23 10 0 | ,, ,, |
| ,, 8 .. | 23 10 0 | ,, ,, |
| ,, 9 .. | 23 10 0 | ,, ,, |
| ,, 10 .. | 23 10 0 | ,, ,, |

### AVERAGE MONTHLY PRICES OF RUBIO ORE (MIDDLESBROUGH).

| | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Yearly Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| 1890 .. .. | 0 15 4 | 0 15 4 | 0 15 4 | 0 15 4 | 0 15 4 | 0 15 4 | 0 15 4 | 0 14 3 | 0 14 3 | 0 15 7½ | 0 15 7½ | 0 15 7½ | 0 15 2½ |
| 1891 .. .. | 0 15 7½ | 0 14 2½ | 0 14 2½ | 0 14 2½ | 0 13 6½ | 0 13 6 | 0 13 3½ | 0 13 0 | 0 12 11 | 0 13 0 | 0 13 7 | 0 13 1 | 0 14 0½ |
| 1892 .. .. | 0 13 1 | 0 12 9 | 0 12 9 | 0 12 9 | 0 12 9 | 0 11 10½ | 0 12 1 | 0 12 2 | 0 12 2 | 0 12 0 | 0 12 0 | 0 11 11 | 0 12 4½ |
| 1893 .. .. | 0 11 11 | 0 11 5½ | 0 11 10 | 0 11 10 | 0 12 1½ | 0 12 3 | 0 12 1½ | 0 12 3 | 0 12 1 | 0 12 4 | 0 12 4½ | 0 12 6 | 0 12 0½ |
| 1894 .. .. | 0 12 6 | 0 12 6 | 0 12 7½ | 0 12 1½ | 0 12 4 | 0 12 1 | 0 12 0 | 0 12 0½ | 0 11 10½ | 0 12 2 | 0 12 0 | 0 12 0 | 0 12 1½ |
| 1895 .. .. | 0 12 0 | 0 12 0 | 0 11 10 | 0 12 0 | 0 12 0 | 0 12 3 | 0 12 3 | 0 12 4 | 0 12 4 | 0 12 6 | 0 12 7 | 0 12 6 | 0 12 2½ |
| 1896 .. .. | 0 12 6 | 0 12 6 | 0 12 9 | 0 12 9 | 0 12 9 | 0 12 7 | 0 12 9 | 0 12 9 | 0 12 9 | 0 13 6 | 0 15 0 | 0 14 9 | 0 13 1 |
| 1897 .. .. | 0 15 3 | 0 15 6 | 0 15 3 | 0 15 0 | 0 14 0 | 0 14 3 | 0 14 3 | 0 14 0 | 0 14 0 | 0 15 0 | 0 14 3 | 0 15 3 | 0 14 8 |
| 1898 .. .. | 0 15 0 | 0 14 4 | 0 14 9 | 0 14 6 | 0 15 0 | 0 15 0 | 0 14 0 | 0 14 0 | 0 14 0 | 0 14 9 | 0 15 0 | 0 14 9 | 0 14 7 |
| 1899 .. .. | 0 15 0 | 0 15 3 | 0 15 6 | 0 15 6 | 0 15 9 | 0 16 0 | 0 17 6 | 0 18 0 | 0 17 9 | 0 18 0 | 0 19 0 | 1 0 0 | 0 16 11½ |
| 1900 .. .. | 1 1 0 | 1 0 6 | 1 1 0 | 1 0 9 | 1 1 0 | 1 1 0 | 1 1 3 | 1 1 6 | 1 1 3 | 1 1 3 | 1 0 0 | 0 18 0 | 1 0 8½ |
| 1901 .. .. | 0 17 6 | 0 16 0 | 0 15 0 | 0 14 6 | 0 15 6 | 0 15 9 | 0 14 9 | 0 15 3 | 0 15 9 | 0 15 9 | 0 15 9 | 0 15 9 | 0 15 7½ |
| 1902 .. .. | 0 15 6 | 0 15 0 | 0 16 0 | 0 16 0 | 0 15 6 | 0 15 3 | 0 15 6 | 0 16 0 | 0 16 0 | 0 16 0 | 0 15 9 | 0 15 6 | 0 15 8½ |
| 1903 .. .. | 0 15 6 | 0 16 0 | 0 16 6 | 0 16 3 | 0 16 3 | 0 16 10 | 0 15 9 | 0 15 6 | 0 15 6 | 0 14 9 | 0 14 9 | 0 15 1 | 0 15 8 |
| 1904 .. .. | 0 14 9 | 0 15 3 | 0 15 1 | 0 15 4 | 0 15 3 | 0 15 0 | 0 14 5 | 0 14 6 | 0 14 6 | 0 14 6 | 0 14 6 | 0 14 7 | 0 14 9½ |
| 1905 .. .. | 0 15 3 | 0 15 6 | 0 15 0 | 0 15 3 | 0 15 6 | 0 15 6 | 0 15 6 | 0 15 6 | 0 16 6 | 0 18 6 | 0 18 9 | 0 18 9 | 0 16 3½ |
| 1906 .. .. | 1 0 0 | 1 1 6 | 1 0 0 | 1 0 0 | 0 19 6 | 1 0 0 | 0 19 6 | 0 19 4 | 1 0 6 | 1 1 6 | 1 1 9 | 1 3 6 | 1 0 7 |
| 1907 .. .. | 1 3 6 | 1 2 6 | 1 2 6 | 1 2 0 | 1 1 6 | 1 2 3 | 1 2 3 | 1 2 0 | 1 1 0 | 0 19 0 | 0 18 9 | 0 17 6 | 1 1 2½ |
| 1908 .. .. | 0 16 6 | 0 15 0 | 0 15 6 | 0 15 6 | 0 15 3 | 0 15 0 | 0 15 0 | 0 14 9 | 0 15 0 | 0 16 0 | 0 16 0 | 0 16 0 | 0 15 5½ |
| 1909 .. .. | 0 15 9 | 0 16 3 | 0 16 0 | 0 16 0 | 0 16 3 | 0 16 6 | 0 16 0 | 0 16 0 | 0 17 0 | 0 17 0 | 0 17 6 | 0 17 6 | 0 16 6 |
| 1910 .. .. | 1 0 4 | 1 0 9 | 1 0 9 | 1 0 9 | 1 0 9 | 1 0 9 | 1 0 9 | 1 0 3 | 1 0 3 | 1 0 6½ | 1 1 3 | 1 1 5 | 1 0 9½ |
| 1911 .. .. | 1 2 2½ | 1 2 6 | 1 2 6 | 1 1 11½ | 1 0 11½ | 0 19 6 | 0 19 0 | 0 19 0 | 0 19 1½ | 0 19 6 | 1 0 0½ | 1 1 6½ | 1 0 7½ |
| 1912 .. .. | 1 2 3 | 1 2 6 | 1 2 6 | 1 1 1½ | 1 1 6 | 1 1 6 | 1 1 6 | 1 2 3 | 1 2 6 | 1 3 0 | 1 3 0 | 1 2 11 | 1 2 2½ |
| 1913 .. .. | 1 2 9 | 1 2 2 | 1 1 7½ | 1 1 6 | 1 0 8½ | 1 0 0 | 1 0 0 | 1 0 0 | 0 19 10½ | 0 19 1½ | 0 19 0 | 0 19 0 | 1 0 5½ |
| 1914 .. .. | 0 18 7½ | 0 18 0 | 0 17 9 | 0 17 6 | 0 17 6 | 0 17 6 | 0 17 1½ | 0 19 7½ | 0 18 11½ | 0 17 10½ | 0 18 7½ | 1 1 0½ | 0 18 5½ |
| 1915 .. .. | 1 7 7½ | 1 8 6 | 1 9 3 | 1 10 2½ | 1 8 6 | 1 6 4 | 1 5 10½ | 1 6 0 | 1 6 10½ | 1 10 8½ | 1 13 0 | 1 17 10 | 1 9 1½ |
| 1916 .. .. | 1 18 6 | 2 0 1½ | 2 2 6½ | 2 0 6½ | 1 15 0 | 1 16 3 | 1 18 0 | 1 18 0 | 1 18 0 | — | — | — | — |
| 1917 .. .. | } Price Fixed | | | | | | | | | | | | |
| 1918 .. .. | | | | | | | | | | | | | |
| 1919 .. .. | — | — | — | — | 2 5 7½ | 2 14 4½ | 2 16 4½ | 2 14 0 | 2 13 4½ | 2 13 0 | 2 12 7½ | 2 11 9 | — |
| 1920 .. .. | 2 17 0 | 3 7 9 | 2 15 6 | 3 6 7 | 3 0 0 | 2 15 0 | 2 14 0 | 2 9 9 | 2 7 6 | 2 11 0 | 2 12 3 | 2 10 0 | 2 15 0 |
| 1921 .. .. | 2 1 0 | 2 0 1½ | 1 18 3 | 1 17 6 | 1 17 6 | 1 17 6 | 1 17 6 | 1 5 0 | 1 8 9½ | 1 7 9 | 1 7 0 | 1 7 0 | 1 13 8½ |
| 1922 .. .. | 1 6 7½ | 1 5 10½ | 1 6 11 | 1 7 0 | 1 7 0 | 1 7 0 | 1 5 3 | 1 4 9½ | 1 4 2½ | 1 3 3½ | 1 2 6 | 1 2 3 | 1 5 2½ |
| 1923 .. .. | 1 2 9½ | 1 4 6½ | 1 5 2 | 1 4 8½ | 1 4 6 | 1 4 0 | 1 3 6 | 1 3 0 | 1 3 0 | 1 3 0 | 1 3 2½ | 1 4 9 | 1 3 10½ |
| 1924 .. .. | 1 4 2½ | 1 4 0 | 1 4 0 | 1 3 7½ | 1 3 8½ | 1 3 6 | 1 2 11 | 1 2 6 | 1 2 1½ | 1 1 7½ | 1 2 3 | 1 2 6 | 1 3 1 |
| 1925 .. .. | 1 2 6 | 1 2 1½ | 1 2 0 | 1 2 0 | 1 2 0 | 1 1 6 | 1 0 6 | 1 0 0 | 1 0 0 | 1 0 0 | 1 0 3 | 1 0 10½ | 1 1 1½ |
| 1926 .. .. | 1 1 1½ | 1 1 6 | 1 1 6 | 1 1 3½ | 1 1 3 | 1 1 5½ | 1 1 6 | 1 1 0* | 1 1 0* | 1 1 6* | 1 1 6* | * | 1 1 4½ |
| 1927 .. .. | 1 2 1½ | 1 2 3 | 1 2 1½ | 1 2 0 | 1 2 0 | 1 2 0 | 1 1 7½ | 1 1 0 | 1 1 0 | 1 1 0 | 1 1 0 | 1 — 0 | 1 1 7½ |
| 1928 .. .. | 1 1 — | 1 1 1½ | 1 1 11 | 1 2 4½ | 1 2 6 | 1 2 6 | 1 2 6 | 1 2 6 | 1 2 6 | — | — | — | — |

* Prices nominal.


WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

PIG IRON

REGISTERED TRADE MARK

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

19, ST. VINCENT PLACE, GLASGOW.

ZETLAND ROAD, MIDDLESBROUGH.

## SMALL ADVERTISEMENTS.

### *Notice.*

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***(A remittance should accompany instructions.)***

### SITUATIONS VACANT AND WANTED.

EXPERIENCED Pattern Plate Maker required; must be used to hydraulic squeeze methods; excellent job for the right man; Birmingham district.—Reply, giving full particulars, which will be treated in strict confidence, Box 834, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

SENIOR Electric Welder (Carbon Arc) desires change; 13 years' experience; age 28; steel foundry preferred.—Apply, Box 826, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

EXPERIENCED Engineer and Foundry Manager desires position; practical and theoretical training; expert in use of moulding machines and design of pattern plates; also cupola control and metal mixing, heavy or light work; highest references for integrity and ability.—Box 814, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRYMAN, 23, experienced in dry and green sand moulding, plate and repetition work, etc., sound technical training in grey and malleable iron, seeks progressive situation.—Box 838, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

EXPERIENCED ANNEALER requires post; 12 years charge, annealing high-grade malleable castings in Midlands; references excellent.—Box 836, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PNEULEC, LIMITED, require a Representative, with practical Foundry experience, for the Lancashire and Yorkshire district. Applicants should give full information with regard to experience, salary, etc.—Pneulec, Limited, Mafeking Road, Smethwick.

THE GOVERNMENT OF INDIA require TWO INSPECTORS OF STORES (STRUCTURAL)

for service in the Indian Stores Department. Candidates must possess a University Degree in Engineering, or good general education up to the standard of the Institution of Civil Engineers or of the Institution of Mechanical Engineers, and drawing-office experience, and have served a regular apprenticeship in structural engineering workshops. It is essential that they should have specialised in structural steel and bridge work. Age preferably between 24 and 33 years of age.

Agreement for five years in the first instance. The scale of pay applicable to both appointments is Rs.500, rising by annual increments of Rs.50 to Rs. 750 a calendar month, with a personal allowance of Rs.200 a month and certain other allowances. The selected candidates will be granted a commencing rate of pay within this scale commensurate with their age and qualifications. Free First-Class passage to India. Provident Fund.

Further particulars and forms of application may be obtained upon request by postcard to the Secretary to the High Commissioner for India, General Department, 42, Grosvenor Gardens, London, S.W.1. Last date for receipt of applications 20th October, 1928.

### MACHINERY.

SANDBLAST COMPRESSORS.—Two new vertical water jacketed Compressors, totally enclosed type, duty 585 cub. ft. to 40 lbs. working pressure; specially suited to sandblast work; £90 each.—Alexander Hammond, Foundry Machinery Merchant, Boxted, Slough.

'Phone **98** Staines.

Electric-driven High Pressure Blower, 6-in. delivery, 110 volts D.C.

Steam-driven Westinghouse Compressor, 150 c.f., 100 lbs. pressure.

Vertical Air Receiver, 8 ft. x 4 ft., 100 lbs. w.p.

100-h.p. Petter Twin Cylinder Vertical Crude Oil Engine.

Harry H. Gardam & Company, Limited, Staines.

New 9-in. centres POLLOCK & MACNAB Combination Turret Lathe, on 8 ft. 3 in. bed.

New 7-in. centres POLLOCK & MACNAB Combination Turret Lathe, on 6 ft. 6 in. bed.

SUNDERLAND No. 7A Gear Generating Machine.

New 7-in. centres Oil Grooving Lathe, hole in spindle 3½ in.

FOURTEEN (14) SINGLE-GEARED STEAM WINCHES (Lidgerwood); pair cyls. 8½ in. diam. x 8 in. stroke; drum, 16½ in. diam. x 19 in. wide; brake.

3-ft. GAUGE 4-wheel 8-in. LOCOMOTIVE (Hudswell Clarke), copper firebox; 160 lbs. W.P.

Two VERTICAL "COCHRAN" BOILERS, 11 ft. 3 in. high x 5 ft. diam.; reinsure 150 lbs. pressure.

**CATALOGUE (10,000 Lots) ON APPLICATION.**

**THOS. W. WARD LTD.,**
**ALBION WORKS, SHEFFIELD.**

SAND MIXERS AND CORE-MAKING MACHINES.—Ask for our quotation for new Machines; prices from £14 upwards. Write for List.

SULRON, LIMITED,
FOUNDRY ENGINEERS,
CLOISTER WORKS,
CONGRESS STREET, SHEFFIELD.

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### AUCTION SALE.

PRELIMINARY.

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LOMAX, SONS & MILLS have received instructions from the Liquidator herein to SELL BY AUCTION on the premises, as above, on THURSDAY, OCTOBER 25, 1928, commencing at eleven o'clock prompt, the Old-established

IRON FOUNDRY,

lately in the occupation of Messrs. Wm. Munslow, Ltd., comprising the Leasehold Land, Trade Buildings, Electric Motive Power, Machinery, Plant, Utensils, Office Furniture, and Effects.

The PROPERTY and CONTENTS in the FIRST INSTANCE will be offered as a WHOLE, and if not so disposed of the LAND and BUILDINGS will be offered together, and the PLANT disposed of PIECEMEAL, as per catalogue, which is now in the course of preparation.

For further particulars see future advertisements, or in the meantime apply to the Auctioneers, Clarence Buildings, 2, Booth Street, Manchester (Tel. 3668 Central), and Central Chambers, Bolton (Tel. 181); R. Smethurst, Esq.; Messrs. Grierson, Sons & Smethurst, Chartered Accountants, 21, Spring Gardens, Manchester; or to Messrs. Brownsword & Arnold, Solicitors, 86, King Street, Manchester.

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